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Notice of the Mammals of Tibet, with Descriptions and Plates of some new Species. By B. H. HODGSON, ESQ., Bengal Civil Service.

Very little is known accurately of the Zoology of Tibet. Having lately received some valuable materials for its illustration from Digurchee and Lassa, I purpose, with the aid of these specimens, and of information procured orally and from books, to give a cursory notice of the subject.

CARNIVORA.

FELIDÆ.

1. Genus *Felis*, *F. Uncia*. Exactly answers Buffon's description, and is evidently the representative in high latitudes of the tropical Leopards. Equal in size to a Leopard of the largest dimensions, and distinguished not only by its long full pelage and very thick tail, thicker even than in *Macrocelis*, but also by its massive structure and for the comparative absence of compression in the talons, wherein there is a vague approach to *Cynailurus*. Length from snout to vent about four feet, and the tail about $2\frac{1}{4}$ to $2\frac{1}{2}$ feet. Never met with on this side the snows, and is said to be a cowardly unenterprising animal compared with the next species.*

2. *Felis Macrocelis*. Found on both sides of the snow in lofty Cisalpine sites as well as in Tibet; osculant in habitat, and in structure be-

* There is a fine stuffed specimen of *Felis uncia* in the British Museum, procured, I believe, in the North of Persia, from which locality, Col. Hamilton Smith also saw a skin of this species, which he has represented in Griffith's Animal Kingdom, II, 469. I am not certain that the *F. irbis*, or long-haired Altaic Panther, of Humboldt and Ehrenberg is distinct from the Ounce, but have no description of the *Irbis* to refer to.—*Cur. As. Soc.*

tween the typical pards of the south and of the north; agrees with the last in its massive form, long full fur and thick tail, which last, however, is proportionally longer and hardly so thick. *Macrocelis* is further distinguished remarkably by the unusual length, slenderness, and insulation of the canines. In these hills, Europeans frequently confound it with the Leopards, thereby increasing the difficulty of deciding how many true pards there be, though its dull hue, and the more chain-like linear form of its marks ought at once to prevent such mistakes. In size too it is considerably less than the true Leopard; but its body has a length from snout to vent of about $3\frac{1}{2}$ feet, and the tail is nearly 3 feet more. I have several skins procured in the Kachâr of Nepal, in Sikim, and from Digurchee in Tibet. The animal is most fierce and destructive among the flocks.*

3. *Felis Lynchus*, *Lynchus Europæus* vel *Vulgaris*. Answers exactly to the common type. Is never seen in India any where on this side of the Hemâchal, but is common in Tibet. Possess two skins from Lassa, one of which exhibits dimensions in excess of those usually ascribed to the species by authors. Snout to rump 38 inches, tail $9\frac{1}{4}$ inches.†

4. *Felis Nepalensis*, necnon *Bengalensis*. Possess one skin brought from beyond the snow, where however the species is rarer much than in the Cisalpine forests.

5. *Felis Domesticus*. The house Cat is common in Tibet. My collection exhibits from Lassa three skins, two black, and the third fawn and white one, with 9 to 10 caudal rings on the paler ground.

6. *Felis Nigripictus*, *Mihi*, new.‡ Size and general proportions of *Catus*, structure typical. Fur very rich and soft, consisting mostly of the inner woolly piles, the longer and hairy ones being scater; average length of the latter $1\frac{1}{2}$ inch, with some few hairs as much as $2\frac{1}{2}$; average length of the former or inner fleece, $1\frac{1}{4}$ inch. General hue rufescent pale cat-grey, like *Chaus*, but paler and fading into rufescent hoary without any black tipt piles below and on the limbs: pads

* That this fine species, originally discovered in Sumatra, should also inhabit Tibet, is a remarkable circumstance.—*Cur. As. Soc.*

† There are four distinct species of European Lynxes; and the dimensions above given would seem to refer this one to *F. cervaria*: but I will prepare a monograph of the group.—*Ibid.*

‡ Clearly the *F. manul* of Pallas, a description of which may be found in Shaw's *Zoology*, I, 362, and which Mr. Hodgson has thus the merit of further establishing, inasmuch as it has been regarded as a doubtful species.—*Ibid.*

postally deep rusty: whole chest and front of neck and part of belly confluent sooty black, terminating forward near the ears hornwise or crescentwise: on the crown of the head several series of black dots disposed more or less linearly and lengthwise. On the cheeks from eyes to articulation of jaws two sub-parallel zigzag lines of jet black, five to seven straighter lines and less deep in hue laid transversely across the lower back, and blending gradually with the caudal rings, which are, including the small black tip of the tail, about nine in number. These rings of the tail are narrow, with large intervals diminishing towards its tip, as the interstices of the dorsal bars do towards the tail's base. The caudal rings are perfect all round, save the two basal ones that are deficient below, whilst the two apical ones, on the contrary, are rather wider below and nearly or quite connected there; rings and tip of the tail black outside the arms and thighs two or three transverse black bars more or less freckled with the grey hairs of the body. Ears outside grey like the back, but paler: Ears small and much rounded: tail medial, thick and cylindric: mystacial and other bristles, some black, mostly rufescent hoary: outer fur or longer piles quadrannulate from the base with hoary, blackish, pale rufous and black; but on the lower surface of the animal these piles are biannulate only with dusky at base, and the rest rufescent hoary, except on the large pectoral dark mark, throughout which the shorter piles are wholly dark, and the longer the same, save at their mere bases: Inner fur, above or generally, slaty black towards the roots; pale rusty towards the tips. Sexes alike, female less in size: Length from snout to vent 22 to 24 inches, mean height 11 to 12, length of tail 10 to 11.

Remark.—Possess three specimens, the youngest shewing the marks most clearly, which in the others are grizzled with hoary; in one specimen the tail appears thin, and shews the rings very glaringly, owing to the outer or longer piles being wanting. Found in the wild state generally throughout Tibet, where all cat skins, tame and wild, are much prized for lining dresses, and the animals for food by the Chinese located there.*

* There is a *Felis inconspicua*, Gray, suspected to be from Nipal, and described in *Mag. Nat. Hist., N. S., I, 577*. "Grizzle-grey, black and white, slightly varied with brownish streaks and waves; beneath white. Back of ears, large spots and cross-bands on the throat, belly, and outside of the legs, black. Two obscure streaks on the cheeks, yellowish, tail elongates cylindrical, grizzled, soles grizzled."

CANIDÆ.

7. Genus *Canis*. Tame dogs abound, and are much prized by the men for guarding the flocks and herds and houses, and by the women for petting. For the former purpose the Tibetan mastiff is used, of which there are several varieties, black, black and tan, or red with more or less of white. Some have the fifth toe behind. The breed at Lassa and Digurehee are the largest and best. They are good tempered, but dull and heavy, except on their night watch, and are utterly useless for sporting. Nor are any other breeds cultivated for sporting. The ladies dogs are Poodles and Terriers, many of which are pretty, and have long soft hair. The latter flourish in Nepal; the former cannot endure our heat. The Chinese at Lassa and Digurehee fatten the Poodles for the table.

8. Genus *Cúon*, *C. Primævus*. The wild dogs of the Cis-Himalayan regions are found also in Tibet, but rarely. I have four skins from Lassa, but they are all of very young animals. The breed of Tibet is large, and of a pale wolf-like colour.

9. Genus *Vulpes*, *V. Montanus*. Yet commoner in Tibet than on this side of the snows. I have 8 or 9 skins from Lassa, which offer no subject for remark.

10. *Vulpes Ferrilatus*, *Mihi*, new iron-grey sided Fox. Structure typical: size less than that of *Montanus*, but much larger than the ordinary Indian type. Possessed of the white tail-tip of the former, but not of its long and silky pelage. Fur very close, thick, porrect almost, harsher and shorter than in *Montanus*, very similar to that of *Indicus vel Bengalensis*. Inner fleece the more abundant, woolly and wavy as usual, and about one inch long; outer piles straight, elastic, and from $1\frac{1}{4}$ to $1\frac{1}{2}$ inch in length: Brush full, of average length, with a pelage reaching to $2\frac{1}{3}$ inches long. Colour, above and on the limbs bright rusty, laterally, and the tail iron-grey; below and tip of the tail, albescens-rufous: the lateral and inferior hues divided on the flanks by a rufous line and on the neck by a blackish one: Ears outside eoneolous with the upper surface of the animal or rusty: a vague transverse black bar across the upper surface of the tail near its base: mystaceal and other bristles long, strong, and black. Sexes alike: females smaller. Snout to rump 26 inches: Tail with the hair, 12 to 13 inches. Inner fur unringed, and of the leading proximate external hue.

outer fur quadrannulate alternately with hoary and black ; but on the ruddy black of the animal biannulate only, with blackish at the base and rusty at the tip.

Remark.—Possess four skins brought from Lassa ; animal common in Eastern and Central Tibet, where also *Montanus* is yet more frequent. Fur prized by the furriers.

MUSTELIDÆ.

VIVERRINÆ.

11. Subgenus *Viverra*. *V. Melanurus*.

12. *V. Civettoïdes*. Possess skins of both these species, brought from the Himalayan districts, but on this side the central crests or spine of the snowy region.

13. Genus *Paradoxurus*, *P. Nipalensis*. I have one skin obtained at Kootee, but this and the last two belong properly to the Zoology of Nepal and India, not of Tibet.

14. *P. Laniger*. One skin from Tingree. Its purely woolly curled and thick fur indicates its northern locale on the verge of the habitat of the genus.

SUBGENUS MUSTELA.

15. *M. Canigula*, *Mihi*, new. Hoary-necked red Weasel ; structure typical so far as appears. Fur or pelage thick, short, moderately applied, softly elastic, with an inner or woolly addition, and a somewhat longer and laxer display on the tail, which is rather more than half the length of the animal, slightly tapered and ends in the usual pointed prolongation of the terminal hair ; colour, throughout cinnamon red, without black tip to the tail, but the chaffron and entire head and neck below hoary. Mystaceal bristles small, rigid, and of brown red hue ; average length of the longer piles $\frac{11}{16}$ inch on the body, and on the tail one inch : average length of the shorter woolly piles $\frac{1}{2}$ inch : colour of the latter somewhat embrowned and dusky towards the base ; but towards the tips, with the entire length of the longer piles, pure cinnamon-red, like the general external hue of the animal. Snout to rump $15\frac{1}{2}$ inches : head $2\frac{3}{4}$, tail only $7\frac{1}{2}$; tail and hair $9\frac{1}{2}$.

Remark.—Common in Tibet : rarer in the Himalayan region :* pos-

* *M. Canigula* is a new addition to the Mammalogy of Nepal ; and *Sorex Nemicola* is another, since my Catalogue was printed.

sess three specimens, the largest, above described, from Lassa. The young have the hoary colour much less developed, and the red hue duller. My specimens want the hind molars, so that I cannot positively assert whether the species belong to the subgenus *Mustela*, or to that of *Martes*, but I feel pretty sure to the former.*

16. *M. Erminca*. Common in Tibet, where the skins enter largely into the peltry trade with China. Possess one specimen in the winter robe of the species, which is found also in the Himalaya, I hear.

17. *M. Auriventer*, vel *Kathia*. Found on the Tibetian as well as Indian slopes from the spine of the snowy region. Possess a skin from T'ingree.

18. *M. Sub-Hemachalanus*. Since this species was first described, (*Journal*, July, 1837,) I have obtained several specimens from Tibet, as well as from the Himalayan districts, *cis et trans nivem*. The largest specimen is $15\frac{1}{2}$ inches from snout to rump, head $2\frac{1}{2}$, tail only 6. Tail and hair $7\frac{1}{2}$. Planta $1\frac{3}{4}$. The smallest is $10\frac{1}{2}$ inches long, and the tail 4 more, or 5 with the hair. The former is of a bright bay or brown red with labial edge; whole chin and spot on middle of front neck, hoary. Bridge of nose and last third of tail, brown black. The latter is of a deeper and duller hue or smoky brown, with the lower jaw and lips albescent; and the nose and end of tail blackish as before.†

Remark.—All the above Musteline animals are much prized in Tibet for their skins, which the Chinese located there cure, and in Nepal, for their ability in killing vermin, though *Auriventer* be the species most commonly so used. None are ever found in Nipal, south of the Kachar, or northern region. The belly is never white in any of the species, but deep aureous in *Auriventer* and invariably so; concolorous with the back in the rest. The pale hue under the head and neck extends with age. The fur is rather longer in *Canigula*, and the tail proportionally longer.

* In typical *Martes* there is an additional false molar on each side of both jaws to what is ever found on *Mustela*, though the dental formula of the latter exists in a large Neilgheiry Marten, which Mr. Walter Elliot shewed to me at Madras, and of which the Zoological Society possess a specimen marked 308 a, in Mr. Waterhouse's printed Catalogue of the Society's Museum.—*Cur. As. Soc.*

† The Darjeeling *Mustela* described in my Report for January (*ante*, p. 98,) would seem to be referrible to this species, and I now think that the white mottling of the shoulders was merely the commencement of a general change to white, as in the Ermine.—*Ibid.*

19. *Mustela Calotis*. The only specimen I have, is from the interior of Tibet. It has been recently described elsewhere.*

SUBGENUS MARTES.

20. *Martes Flavigula*. One specimen lately came to me from the Tibetan slopes of the Hemáchal, but the species is probably confined to the juxta Himalayan districts; for its natural habitat is the central region of Nepal, where it represents the true *Mustelæ* of the northern.

21. *Martes* (?) *Toufœus*, new, Mihi. Toufee of the peltry trade of the Chinese and Tibetans, who prize the skin very highly, next indeed to the sable. Have several fine skins from Lassa and Siling, but as they want the teeth and talons and tail, I can but conjecture from information and the specimens as they are, that the animal is a Marten. Thus judging, I should say, the Toufee has much of the size and proportions of the last or *Flavigula*; but its pelage is much richer and softer. In softness it equals the *Vulpes Montanus*, and is much fuller of fur or thicker; the longer piles being very glossy. Probable length from snout to vent 20 to 22 inches, mean height 7. Length of head about $4\frac{1}{2}$; of auricle or free helix $1\frac{1}{4}$. Average length of the outer or hairy piles $1\frac{3}{4}$ inch, of the inner and woolly $1\frac{1}{4}$ inch. General colour smoky brown, darker along the spine and on the limbs, but without marks, and paled to sordid yellowish hoary on the neck and head: head palest except the mystaceal region and chin, which are embrowned: moustache moderate and dark brown. There are no rings on the outer or inner piles, which have both the general smoky brown hue of the exterior, only paler at the roots.

* The *M. Sebirica* of Pallas, described in Shaw's 'Zoology,' I, 431, is another species which may perhaps turn up in Tibet.—I may also here notice a species which I believe to be now first distinguished from *M. putorius* viz. the Russian Pole-cat of the English furriers, which is quite a distinct species from that of Germany and Britain. I had an opportunity of comparing many very large bundles of skins of both animals at one of the Hudson's Bay Company's half-yearly exhibitions, those of genuine *putorius*, having been imported from Germany, and being quite undistinguishable from the animal of Britain. The Russian species is considerably smaller, not exceeding the Stoat or Ermine in size, with tail (vertebra) measuring $4\frac{1}{2}$ inches or with its hair $6\frac{1}{2}$ inches. Pelage nearly similar to that of the British Pitch or 'Pole-cat,' but apparently becoming nearly white in winter: and all the multitude of skins I saw had the pale ground-tint much whiter, and more predominating, than in the very numerous examples of *M. putorius* examined on the same occasion. This Russian species may be styled *M. putorius*."—*Cur. As. Soc.*

22. Genus *Lutra*, L. *Aurobrunnea*. This and another small species of Otter are found in Tibet, but rarely, and the vast demand caused by the Tibetan and Chinese fancy for furs is supplied from Sylhet and Daeca chiefly, and in a less degree by these mountains, in the article of Otter skins.

URSINÆ.

GENUS *URSUS*.

23. *Ursus Isabellinus*. Fragments of a skin from the further and Tibetan slopes of the Hemâchal, none from the plain of Tibet, where there are said to be no Bears. The species never wanders south of the Kachar on this side the snows, and is represented in the central region of Nipal by *Tibetanus*, (a species unknown not only to Tibet, but to the Kachar of Nipal,) and in the southern by *Labiatus*.

ANAPTOTHERES.

24. Genus *Sus*, S. *Scophra*, tame. Pigs of the common Indian and also of one or two Chinese breeds are commonly kept and eaten in Tibet, except by the religionists. No wild ones exist there.*

Ruminantes Bovinæ.

GENUS *Bos*.

25. Subgenus *Bison*, B. *Pocphagus*. Found in the wild as well as tame state in Tibet, where the tame ones abound, and are put to all uses. In Nepal they will not live south of the Kachar.†

26. Sub-genus *Bos*.—Bovines other than the Yak or last named, are rare in the tame state, and unknown in the wild. There are, however, three tame breeds of Cows, chiefly kept by the rich for their milk, whilst the poor Yak is the beast of burden, of agricultural labour, and of the beef market.

CAPRIDÆ.

GENUS *PANTHOLOPS*.

27. *Pantholops Hodgsonii*. Common all over the open plains of Central and Eastern Tibet: never passes nor nears the Hemâchal.

* In the country of the Usbeks, Wild Hogs would appear to be very numerous. "Descending the eastern side of the Junas Durah," writes Lieut. Wood, "our march was rendered less fatiguing by following hog-tracks in the snow; so numerous are these animals, that they had trodden down the snow as if a large flock of sheep had been driven over it." *Journey to the Source of Oxus*.—*Cur. As. Soc.*

† Wild Yaks exist on the mountains towards Yarkund; but their colour and size, as well as general habits, remain to be described.—*Ibid.*

GENUS CAPRA, Wild.

28. *Capra Ibex*.* Found on the Tibetan slopes of the Himalaya, and in the other high mountains of Tibet, north of Lassa and Digurchee, as well as towards the frontier of China. Have no specimen thence.

29. Genus *Capra*, tame. The shawl goats, of which there are three races, diminishing in size from the common or standard one, abound all over Tibet, almost to the exclusion of other species. The finest breed is that of Nâree or Eastern Tibet, near the snowy region : but the wool is good all along the Hemâchal on both slopes, and some years ago the minister of Nepal established at Katmandoo a colony of Cashmirees to make shawls. Why not we in Kumaoon, or West of it ?

GENUS OVIS, Wild.

30, 31, 32. Three species, *Ammon*, *Ammonoïdes* and *Nâhōor*. All are said to be found in the mountains of the interior of Tibet, as well as on the Tibetan slopes of the Hemâchal, where, however, the *Nâhōor* species is the most common ; but I have lately received a fine pair of horns, with the frontlet attached, of *Ammonoides* vel *Ammon*, (*si sic decretum fuerit*.) from the same region ; viz. the Mustang district. *Ammon* the monster, with the monstrous horns, is, I believe, distinct and most common in, if not limited to, the Tartar regions confining with Tibet on its North. Mr. Blyth's *Ovis Burrhel* is no other than my *Nâhōor*, Mr. B.'s specimen of which was dyed brown by a preservative lotion that was applied by the killer and curer of it, Lieut. Smith, 15th N. I. ! †

* *C. Sakeen*, Nobis. Distinct from the Alpine Ibex, and still more so from that of Siberia.—*Ibid*.

† There is a Rowland for Mr. Blyth's Oliver, given however in all courtesie. The local Naturalist must be pardoned a smile when the Master of a Library and Museum, confounding the essentials with the accessories of species, edits a new being as unskillful as his unprovided ally of the field department.

Note by Mr. Blyth.—Mr. Hodgson will, I trust, consent to suppress his smile, and thus further extend his courtesie to me, when I inform him, that I was originally induced to distinguish *Ovis Burrhel* from *O. Nahoar*, in consequence of the decided difference in the sectional form and general aspect of the horns of these two species. I happened to be employing an artist to draw the specimen of *O. Burrhel* in the Zoological Society's Museum, when chancing to take up a frontlet of *O. Nahoar* that was lying beside me, and holding it to the stuffed *Burrhel*'s head, I saw at a glance that they were distinct species, and I subsequently (as mentioned in my paper on the species of wild Sheep) met with another specimen of a *Burrhel*'s horn, wherein the specific character was equally well marked.

The ears of *O. Burrhel* are also conspicuously shorter than in *O. Nahoar* ; and the tail appears to be reduced to a mere rudiment : it has been thought, indeed, that the

33. Genus *Ovis*, tame. Vast flocks of the graceful and valuable Hoonia are reared all over Tibet, for food, clothing and carriage, and exclusively almost of any other breed. They flourish also in the Kachar of Nepal, though not south of it, and even in the Kachar their wool degenerates. To procure the Hoonia from north-eastern Tibet, ought to be an object of zealous endeavour on the part of the Agricultural Society, which should likewise obtain the Kachar breed of the same animal, the former for export to Europe, (for it would not live in India,) the latter for attempts at crossing with the common long-tailed breed of Gangetic India. The Goats and Sheep of the Hemáchal and Tibet have the finest fleeces in the world: the Goats and Sheep of the plains of India, almost the worst.* Should the rulers of the latter region not essay to make their apathetic subjects profit by the circumstance?

CERVIDÆ.

GENUS CERVUS.

34. Sub-genus *Pseudo Cervus*, C. Wallichii. This species is alleged to tenant the plains of Tibet in hilly and woody situations, as well as the Tibetan slopes from the spine of the Hemáchal. But I have no further

tail of the Zoological Society's specimen had been lost, but on minute examination I arrived at the conclusion, that the whole skin of this part was present, though longitudinally divided, and what confirmed me in this belief was, the circumstance of the *pale space* that should be covered by the tail being exactly of corresponding dimensions to the size of what I judge to be the whole of this appendage; of course, I allude to the appearance as if *etiolated*, which contrasts in this respect with the colour of the surrounding parts.

Of the veritable *Nahoor*, I have seen some considerable number of horns, (there are four frontlets of males in the Asiatic Society's Museum,) but never any that I could mistake for those of the Burrhel.—Comparative figures of them are given, along with those of other species described by me, in the *Annals and Magazine of Natural History*, for September, 1841; where, however, the names are unfortunately transposed, the appellation *Nahoor* being affixed to the Burrhel, and *vice versâ*.

With respect to *O. Ammonoides*, Hodgson, should it really prove different from *O. Ammon*, it will be remembered that I had dedicated this animal to Mr. Hodgson himself, terming it *Hodgsonii*, some time before the publication of the name *Ammonoides*; so, likewise, Capt. Hutton's designation *Cycloceros*, applied to the wild Sheep of the Hindu Koosh ranges, and which, by the way, is equally applicable to the Corsican *O. Musimon*, must yield to my prior name of *Vignei*.

Mr. Hodgson, in his *trans-nivean* researches, should strive to procure some information respecting my superlatively magnificent *Ovis Polii*, to which even the "monster *Ammon*" yields precedence for grandeur, as it assuredly does for elegance and beauty. The only locality at present known for this fine species is the Steppes of Pamir.—E. B.

* The Agricultural Society or any other body may command my willing services in aid of any exertions to improve the fleeces of our Indian or English Sheep.

specimen thence. That from which the original description of Hardwicke was taken, was obtained alive from Muktinath in the Himalayan region of Tibet, and considerably beyond the boundary of Nepal. Than such a habitat nothing can be more diametrically opposite to the Saul forest of the Morung, whence our *Cervus Affinis* was procured; and I therefore still believe in the distinctness of the two species, the more particularly as I conceive that the small disparity of age between the specimens compared is inadequate, even with the aid of other admitted differential accessories, to account for the vast and palpable differences exhibited by the horns. Mr. Blyth allows but about a year's difference of age between the specimens; yet the horns of *Affinis* are much more than double the size of those of *Wallichii* (as 9 to 4) whilst what he insists is the median, and I the subterminal, snag of the horns of *Wallichii*, has an interval from the basal snag as large nearly as in *Affinis*. Wherefore I say the snag in question of the horns of *Wallichii* is not a median; and that the species wants that significant mark of the true Elaphoid form.* Lastly, Wallich's stag is known to the Nepalese by the name Gyâna Mriga; *Affinis*, by that of Mool Bara Singha, that is, chief or royal stag; and I deem it generally prudent to rely on distinctions attested by this sort of evidence.

MOSCHIDÆ.

GENUS MOSCHUS.

35, 36, 37. *M. Chrysogaster*, *M. Leucogaster*, *M. Saturatus*. All these species abound in the lofty mountains of the interior of Tibet, especially towards the Chinese frontier, where the first and loveliest, or *Chrysogaster*, is almost exclusively found. On the Tibetan slopes of the Hemâchal, *Saturatus* chiefly resides, and it is difficult to distinguish this species from the *Moschatus* of Linné, belonging to the interior, otherwise than by the coarser structure of the musk pod, and inferior quality and quantity of its contents (on an average) in *Saturatus*. I have specimens of all three species from Lassa and Digurchee, whilst my garden is seldom deprived of the ornament of several live samples of the *Saturatus* of the Kachâr. The trade with Europe in Musk is declining greatly of late, probably because its repute as a medicine is becoming fast exploded.

* Mr. Hodgson should bear in mind, that the horns which he refers to are, most obviously, those of a young animal which had not assumed their typical conformation.—*Cur. As. Soc.*

Much is still sent to China, and chiefly from the Dokpa district, six stages east of Lassa. It is, *par excellence*, the Kaghaze, that is, thin-as-paper pod, and is principally obtained from *M. Chrysogaster*.

GENUS EQUUS.

38. *Equus Caballus*, tame. From China to Bokhara through Tibet, there are found few or no horses, but a great variety of ponies, all remarkable for their excellence for mountainous travelling. Towards and in China, the breed appears to be the smallest and highest spirited, shewing as much blood as the finest Java pony. Towards and in the Himalayan districts, there is more size and bone, but less fire. The breeds of Eastern Tibet, such as the Poomi and Gyanché, best unite the two properties of the others, or strength and spirit; whilst towards *Western* Tibet, there is a gradual increase of size till you reach the Choughosa "Cob" of Samarcund and Bokhara. In most of the Cis-Himalayan districts, likewise from Kumaon to Deo Dharma, "Hill ponies," as we call them, are bred, but none of them equal, I think, to the Trans-Himalayan races, among which I prefer that of Lassa, a smallish breed, but stronger and larger than the gallant little "Chinia," and not materially or inconveniently less resolute or animated. The proposed Gorkha corps of mounted riflemen should, if possible, be furnished with some good breed of these ponies.

39. *Equus*, wild; *E. Kiang*, Moorcroft; *E. Hemione*, Auct.? Found generally throughout Tibet. I have no specimen.*

* Mr. Moorcroft remarks of this animal ('Travels', Residence at Ladakh, I. 311), that "it is certainly not the *Gurkhor*, or wild Ass of Sindh," which is the *Hemione*; see also p. 443 of the same volume for some description of this Kiang, which Dr. Gerard met with "in great herds" on the Himalaya, at an altitude of 17,700 feet; indeed it appears to be essentially a mountain animal, which "bounds up the rocks" with speed and facility; whereas the *Hemione* is rather an inhabitant of the sandy level. Col. Hamilton Smith, in his admirable treatise on the *Equidæ*, (*Nat. Libr., Mam.*, XII,) conceives the Kiang to be one of several existing wild species of true Horse, and suggests that the "wild Asses" of Bell, with hair "waved white and brown," some skins of which were seen by that traveller near the sources of the Oby, may refer to no other; but this is mere conjecture, and Col. Smith appears to me to be little warranted in his endeavour to derive the pie-bald races of horses from this peculiar stock.

I may take this opportunity of remarking, too, that I entertain considerable doubts as to whether the reputed "wild Ass" of Prof. Gemelin be aught but a variety of the *Hemione*: the female observed by that naturalist had no cross-stripe over its shoulders, such as was found in the male, and is, so far as I have observed (and my attention has been long directed to the subject), invariably constant in the domestic Ass; whereas in the Mongolian *Onager*, M. Gmelin was informed that the mark

40. *Asinus Equioides*, Mihi. Species wants verification, spoken of by Moorcroft and others : called wild Ass by the Tibetans, and said to be common on the plains of Tibet. Possess no specimen.

RODENTIA.

MURIDÆ.

41. Genus *Mus*. Rats and mice are said to be common in Tibet, but I have no specimens, and cannot therefore indicate species.

42. Genus *Sorex*. One small species, *Tibetanus* ; no describable specimen.

43. Genus *Arctomys*, *A. Hemalayanus*. Possess many skins from the interior of Tibet, where the species is very common, and where also are found some rarer murine forms that I have no means to illustrate, such as the one adverted to by Moorcroft (I. 312). The traders of Nepal of the Newar race, who are often domiciled in Tibet, upon seeing my specimens of *Rhizomys Badius*, assure me, that this is the ordinary house rat of Tibet, and no other than the animal indicated by Moorcroft.

referred to is by no means constant (as his two specimens testified), and sometimes there is even a double cross-band over the shoulders. Now with respect to the undoubted *Hemione*, I may remark that an uncommonly fine male, which is probably still living in the Surrey Zoological Gardens, has a very distinct incipient cross over its shoulders, more developed on one side than on the other, though not above an inch or so on the former; and therefore it is probable enough, that some examples of this species may have the same mark further developed. Whether the *Khur* of Sir R. K. Porter ('Travels,' I. 459), be specifically different from the *Ghore-khur* or *Gurkhor*, i. e. the *Hemione* of modern naturalists, remains also to be ascertained. Of this we are informed, that "no line whatever ran along his back, or crossed his shoulders, such as are seen in the tame species with us;" but "the mane was short and black, as was also a tuft which terminated his tail:" and it is worthy of notice, that this traveller completed the sketch which he has furnished of this animal from a second individual. Certes, a wild Ass, or *Hemione*, of some kind, exists at the foot of *Taurus* (Ainsworth's 'Travels in Assyria,' &c., p. 41); the same or another "is common in the districts of the Thebaid" (Wilkinson's 'Domestic Manners of the Ancient Egyptians,' III. 21); and a "wild Ass" is mentioned in the narrative of Lander's Expedition (p. 571); but of the genuine and indisputable wild *Equus Asinus*, we really possess no definitive information whatever, that should satisfy us of its present existence, however little reason there may be to doubt this; the *Onager* or *Koulan*, as we have seen, being very probably no other than an occasional variety of the *Hemionus*, and the *Hamar* or *Hymar* of Sir R. K. Porter, if really distinct from the last, which is very probable, being still more different from the common tame Ass, since it has no dorsal marking whatever, and the cross stripe of the so called *Onager* even was considerably less developed than in a domestic Donkey. I look to the establishment of Mr. Hodgson's *Asinus Equioides* with much interest; and indeed all the aboriginally wild Equine animals of Central Asia, if we except the modernly termed *Hemionus* alone, are but very vaguely known at present to Zoologists, and should be minutely described by whoever has the good fortune to meet with one.—*Cur. As. Soc.*

Lagomys Nipalensis, again, they allege to be the ordinary field rat of that strange land, *Sed quære?* *Rhizomys* is too tropical a form for Tibet.

44. Genus *Lepus*, L. *Oiostolus*. Common in Tibet near the Hemâchal, and expressly pointed out by Moorcroft (I. 225): but not so common in the central and eastern provinces of Utsâng and Khâm, as the next and much larger species.

45. *L. Pallipes*, White-foot, new, Mihi. Essential structure perfectly typical: particular conformation approximated to that of *Hibernicus* and *Variabilis*: fur very soft and full, as full as, and much softer than, the English hare, and of two sorts, the inner rather more abundant and wavy, the outer, not much longer, straight, and possessed of an uniform structure with very little rigidity, or rather with a slight elasticity and no rigidity. Size of *Variabilis*, but with ears equal to the head. General colour the ordinary hue of the English species, but paler, with less of red and still less of black in it, and the pads yet more completely enveloped in their socks: Groove of the front teeth very deep: whiskers medial, black or white. Body above, except the buttocks, with the whole toes and a list down the fronts of the limbs, pale rusty yellow or ruddy luteous, very moderately sprinkled with black. Ears outside towards the back on the distad opposed halves, with the nape, the buttocks and the limbs, bluish hoary, white almost on the ears and limbs; body below rufescent hoary; rufous on the chest and white under the chin. Ears largely tipped with black (for half an inch): Tail white. Inner fleece inannulate and bluish hoary. Outer piles triannulate with two black rings and one intervening pale rufous zone, none of these latter wholly black, nor longer nor harsher than the rest. Snout to rump 22 to 23 inches, head $4\frac{3}{4}$, ears $4\frac{3}{4}$: Osealcis to longest toe, $4\frac{1}{2}$: Scut without the terminal hair, 4 inches, with it, 6.

Remark. Possess two skins from Lassa and one from Sikim, which however came, no doubt, from beyond the snows originally. I am indebted for it to Dr. Campbell's kindness. The species is that common to all central and eastern Tibet, (Utsâng and Khâm): but in the higher and more mountainous sites of Western Tibet, or Nâree, and also in Ladakh, *Oiostolus* is the more prevalent species. *Macrotus*, or the Indian type, (up to the Himalaya) never crosses the snows, nor is known in Tibet.*

* The *Lepus tolai* of Pallas, "an inhabitant of open hilly places in Dauria and Mongolia, and said to extend as far as Tibet," should be enquired for by Mr. Hodgson. A description is given in Shaw's Zoology, II. 203.—*Cur. As. Soc.*



The Himalayan or Black Sheep. Tibet, m. s. minor.

Red Mountain Squirrel

Vulpes Texillatus Iron-grey sided Fox mibi.

Habitat Tibet

Buller's



Felis Nigripictus mih. 1/2 natural size. Habitat Tibet.



Lepus Pallipes. White Leg milch. Habitat Tibet.



46, 47. Genus *Lagomys*, L. *Nipalensis* et *Royli*. Both are said to be very common in Tibet, even much more so than in the Himalayan districts : but I have no specimens from beyond the snows, and trust to native information upon sight of the skins in my possession. The whole ground on the way from Kooti to Digurchee is said to be often covered by immense groups of *Lagomydes*, whose burrows render the roads unsafe for horsemen. The *Arctomides* collect in the same manner, but in much smaller numbers.

Nepal, 2d April, 1842.

N. B. Those who would consult this Tibetan Catalogue with advantage, had better first refer to the Catalogue of Nipalese Mammals, published in the last No. of the Journal.

Plates attached to this Paper.

1. *Vulpes Ferrilatus*.
2. *Felis Nigripectus*.
3. *Lepus Pallipes*.
4. *Ovis Hoonia*, tame.

Some concluding Remarks forwarded for insertion with Capt. TREMENEER's Report on the Tin Ground of Mergui.

Of the existence of tin in considerable quantities in the province of Mergui, there cannot, from the facts above stated, be much question ; and from the trial of the produce of one man's labour in a given time, there appears to be sufficient to justify every expectation of a profitable employment of labour on an extensive scale.

The places at which the trials were made, were not selected as the best from previous information, but were arrived at more by accident than design, and the stanniferous gravel and sand collected where the bed was tolerably level, stream slack, and where the greatest deposit appeared to have recently occurred.

No part of the bed of the Thabawlick, which was examined, was found wholly destitute of tin, and it is reasonable to conclude, that the ore exists in numerous spots, especially in the vicinity of the hills from which the streams arise, in far greater abundance than is shewn above.

The results, therefore, which are given in detail, can only be considered rough approximations to the quantity of tin these streams would afford, and to the probable out-turn with an establishment properly superintended. Much economy in labour might be effected in collecting the sand and gravel for the washers, but no better mode could, I think, be adopted in separating the tin in the first instance,

than by people accustomed to work with the flat conical-shaped troughs before described. The quantity obtainable, would fully repay the employment of men in this operation.

The tin, as produced by the washers, should be placed on sloping boards, and water conducted over it from a trough pierced with holes for the purpose, in order to get rid of foreign particles; and it would then, after being finely pounded, be ready for smelting. Of all metals tin is in this process the least troublesome, after the ore is freed from the earthy and silicious particles with which in other countries it is often mixed.

The crystallized form in which it here occurs, renders its separation extremely easy, and the whole processes of stamping and dressing, which in England are tedious and expensive, can thus be dispensed with. No arsenic or sulphur being mixed with the ore, it need not be roasted before it is placed in the smelting furnace.

It would thus appear that the tin of the Mergui province offers no ordinary inducement to the outlay of capital, without much of the risk, uncertainty, and large previous outlay usually attending mining adventures.

G. B. TREMENHEERE, *Capt.*
Superintendent of Forests, Tenasserim Provinces.

Errata in the printed Report.

Page	846,	line	10,	et passim,	for Thengdon,	read Thengdaw.
„—	848,	„	16,	for Pak chum,	read Pak chan.	
„—	849,	„	17,	for Loundoungin,	read Londamgin.	
„—	849,	„	18,	for Wolfran,	read Wolfram.	
„—	850,	„	33,	for 63-176 grains,	read 6 oz. 176 grains.	
„—	851,	„	14,	for Kohan,	read Kahan.	

On the Cotton called “Nurma,” in Guzerat. By A. BURN, Esq., Superintendent of Cotton Cultivation, (in reply to MR. PIDDINGTON’S Queries.) Communicated from the Secretariat, General Department.

The plant yielding what is called Nurmah cotton in this part of the country, is the same as is described by Dr. J. F. Royle as *Glossypium Arborium*. It is to be found growing wild, I believe in different parts of India, and from some experiments I made when at Kaira, I have very little doubt that it will be found to be the original stock from whence the Barbadoes, Bourbon, Egyptian, and Sea Island varieties have originally sprung,

It grows in every kind of soil that is met with in Guzerat. But it obtains the greatest perfection in light sandy soils, to which a little old cow-dung manure has been added, and where it can have a *proper drainage*, in the black clayey soil, known as “the cotton soil” of the indigenous *G. herbaceum*; it grows, but with diminished vigour in pro-

portion to the purity of that soil. In a state of nature, and when fully developed, the seeds are nearly as large as a particle of grain, and are closely covered all round by a strongly adhering bright pea-green coloured fur, and enveloped in a fine silky wool of considerable strength, and fully an inch in length.

Hedgerows, gardens, groves of trees about the abodes of devotees and temples, are the places where this plant is found. I don't know of its being cultivated in any other way. In these places it is a perennial, lasting for four or five years or more, and being cut down to within two feet of the ground in the end of June, or a little before the setting in of the annual rains; this also is the best time for sowing the seed.

The natives appreciate this cotton, from its fine staple enabling them to spin finer thread than from any other kind with which they are acquainted. Muslins and long pugries for the head are made from it; but since the introduction to this country of European products of the loom, its use and its culture have been so reduced, as hardly at this day to afford sufficient evidence to save their being classified along with the fabulous stories of Hindoo history.

Of the quantity produced per acre, I can give no estimate; but in the first year, it could not be over 100 lbs. of clean cotton. In the second year, as the plant then comes into full bearing, it might be from three to four hundred pounds. The great extra labour and expense over the common crops, of protecting the fields during the whole year, which the cultivation of this plant would entail, is, I believe, the main obstacle to any attempts being made to cultivate it. Here we have no hedgerows, and nothing that is well calculated for such a purpose; all the agricultural produce being from annuals, the ryot protects them from cattle, thieves, &c. by living in his fields during the few months they are ripening, and which he could not do for a longer period. The price of this cotton in the bazar, is always double that of the common country article. However, there is never more than a few pounds procurable,

I have for several years back entertained great hopes in regard to this cotton, particularly that it may be improved, so as to become of value, by attending to modes of culture. That from it new varieties, suited to different soils and situations as regards climate, may be obtained, is more probable than from any of the cultivated kinds, and I have hoped that circumstances might some day admit of my being able to attempt its culture as a perennial, in the same way as cotton is grown in Peru.

Samples of the Nurmah cotton are forwarded with this letter, procured from different places in and about the city of Broach. As regards soils, I cannot at present obtain any such as could be of use to Mr. Piddington; but when I am relieved from the medical charge and duties of this place, I shall then be able to select, in visiting the country round, proper specimens.

*Broach Office of the Superintendent of American
Cotton Planters, 6th January, 1842.*

On an Ancient Magic Square, cut in a Temple at Gwalior. By Captain SHORTREEDE.

As every thing tending to throw any certain light on the antiquities of India has an interest, I send you the following inscription of a Magic Square, which I copied last year from an old temple in the hill fort of Gwalior. It bears the date **सम्वत् १५४०** = A. D. 1483.

The temple is on the northern side of the hill, and at one time it has been a very magnificent edifice, though now it be sorely dilapidated.

It has formerly suffered from the rude hands of the Musalmans, and more lately it has been excavated under the site of the image to the depth of twenty or twenty-five feet, in the vain hope of finding hidden treasure.

There is another and larger ancient temple in the fort, of a peculiar form, which the Musalmans have converted into a Musjid.

If I remember rightly, the Magic Square is cut on the inner side of the northern wall, close to where the excavation has been made. I did not measure the dimensions ; but the form is as follows :—

१६	८	४	५
३	६	१५	१०
१३	१२	१	८
२	७	१४	११

सम्वत् १५४०

The properties of the square are, that in every way, whether vertically or horizontally, or diagonally, the sum of the numbers is 34 : the diagonals may be summed either in one line as usual, or in two parallel lines ; containing together four numbers thus :—

$$34 = \begin{cases} 16 + 6 + 1 + 11 = 3 + 12 + 14 + 5 = 13 + 7 + 4 + 10 = 2 + 9 + 15 + 8 \\ 16 + 10 + 1 + 7 = 9 + 3 + 8 + 14 = 4 + 6 + 13 + 11 = 2 + 12 + 15 + 5 \end{cases}$$

It will be observed, that the places of the numbers 1, 2, 3, 4, form a rhomboid, as do also 5, 6, 7, 8 ; 9, 10, 11, 12 ; 13, 14, 15, 16. It may be remarked also, that the sum of every two alternate numbers taken diagonally is 17 : and that all these properties will hold good if the lines be transposed vertically or horizontally in the same order ; that is, if the top line be brought to the bottom ; or if the left hand vertical line be carried over to the right.

The whole displays considerable ingenuity, and in connection with the date, may be of use as indicating the former state of arithmetical knowledge.

8th April, 1842.

I add a copy of the inscription in our common numerals, in case it

16	9	4	5	16				
3	6	15	10	3				
13	12	1	8	13	12			
2	7	14	11	2	7	14	11	
	9	4	5	16	9	4	5	
		15	10	3	6	15	10	
				13	12	1	8	
				2				

may be wanted, as also a sample of the way in which it may be extended, which probably is similar to that in Dr. Franklin's Magical Square of Squares, but on this point I cannot speak positively, as I do not distinctly remember the particulars of Dr. Franklin's Square of Squares, and have at present no means of reference.

Report upon the Construction of Philosophical Instruments in India. By Captain J. CAMPBELL, Assistant Surveyor General.

It is, I believe, the intention of Government, that the proposed Madras University shall be an institution in which the principles, or even a complete knowledge, of the Physical Sciences, shall be taught to those who are willing among the Native community.

For this purpose, as apparatus for the lecture tables, and for the exhibition of the principles of machines and the various experiments in Chemistry, Hydrodynamics, Pneumatics, and the effects of Light, a set of instruments will be required, which as adapted for any institution called an University, cannot be procured at a less outlay than £10,000 at least.

It is this set of apparatus which I propose making up in India by the hands of native workmen only, at probably an outlay of little more than 5,000 rupees for the whole, and of such workmanship and

finish as to be comparable, if not as good, as the best which London can produce.

I believe no one, either youth or adult, who was at all interested in the pleasures of the pursuit of science, has ever left a lecture room in London without a secret wish, that he could himself repeat the experiments he has seen performed, and a regret that the apparatus required were beyond his means; and no one intimately acquainted with the character of Natives, and with the keen vivacity with which they regard any thing new or wonderful, will doubt the feeling of regret and humiliation with which they must regard the beautiful apparatus as finished by European workmen; while they examine a balance which takes nearly two minutes to perform a single oscillation, and wonder how it can be made to move so slow and regularly, and which is capable of rendering sensible a quantity no greater than the millionth part of the load which it sustains; when they are told that such an instrument cannot be purchased for less than 500 rupees, and that its execution is utterly beyond the capacity of the Natives of India, and that no instrument submitted to their inspection can they ever be permitted to handle or to use, and if not in affluent circumstances hardly any of the simplest can they ever hope to purchase. It may happen that the idea may strike them, that under such circumstances, what may be the value of listening to an abstract detail of philosophical facts, which they can never hope to investigate themselves, or to prove to their own satisfaction, that they are founded upon truth.

Besides this, the practical application of scientific knowledge can never be turned to account, without a familiar knowledge of the technical mode of exemplifying it.

On the contrary, how much it must assist a teacher of science in being able to fix the attention of his auditory by telling them, that there is not an article exhibited to their view, beautiful and wonderful as they at first may appear, which has not been made by Natives of India, at a price which any but the most indigent can afford, and which any one may become capable of constructing, if they pay attention to the explanation of the principles upon which the instruments have been formed.

That Native workmen are capable of this I have endeavoured to shew in a former report, and have instanced in the allusion to an in-

strument with regard to the powers of which I may mention, that Sir John Herschell, in his Discourse upon Natural Philosophy, has thought it necessary, for fear the fact should be doubted, "to assure the reader that balances have been constructed capable of rendering visibly sensible, a quantity of matter to even the millionth part of the whole;" yet this, which by the passage is evidently considered a great effort of mechanical skill, I have been able to effect by the hands of an Indian workman, totally untaught, except by myself; and with regard to its outward appearance, no one who has yet seen it but has remarked, "How beautifully it is worked," or that "no one would for an instant believe that it was made in India."

It might be remarked in contravention of my propositions, that I endeavour to assert the possibility of rivaling in India the productions of the genius of Ramsden and Troughton, and that the idea is absurd; but however, such it is my intention to assert.

However preposterous the proposition may at first appear, yet it may be shewn, that there is nothing impossible in its execution, for it will at once be seen by any one acquainted with the subject, that the instruments by the aid of which the investigations by which our present knowledge of the laws of matter and unponderable substances have been conducted, owe their excellence not so much to the skill of the mechanical workman, as the ingenuity and talent in adopting means of product to the desired purpose, as shewn by those who directed the construction.

And in fact, what are the beautiful and costly instruments, the expense of which is only within the means of nations, and to which are due the proofs of the profound investigations of modern Astronomy, but large masses of metal, the true form assumed by which at each change of position, has puzzled the investigation of the most penetrating and ingenious, and has caused a competent judge to remark, "that the observations made by a circle of only 12 inches diameter are better, and more worthy of confidence than those procured by all the 3-feet circles, and even the 8-feet circle of Ramsden, which have yet been constructed," and what are the divisions upon them, but a rude attempt, (as referred to what future ages may produce), to divide the circumference into 189,600 parts, which instead of being equal parts, often differ to the amount, $\frac{1}{5}$ of the circumferences and always to $\frac{1}{10}$.

From their unimpassioned character, their slow and quiet habits, their delicate appreciation of touch, and their untiring application, it is probable that a clever Native, if once taught properly the art of dividing the circumference of a circle, might very probably surpass the best effects of the most celebrated workmen of London.

It is supposed by many, that modern discoveries in Optics have improved refracting telescopes by the lenses being better made; but such is not the fact, the lenses of the present day are not in the least better than that Galileo and Heygens were able to make, and it is probable there is hardly a Chinese workman, who does not possess a great deal more skill in polishing a lens, than the best optician in London. I once bought in London a Chinese toy, an imitation of a compound microscope, from which I took lenses so beautifully polished, as to be admired by one of the first opticians in London; and I have little doubt, that a clever workman in India could fashion lenses, with which a refracting telescope could be put together, quite as good as the best which Tully or Dolland ever made.

The above may appear a startling assertion, but no optician will deny the possibility of its being correct; for the fact is, that workmen are totally unable to give a particular required figure to a lens, and lenses of required focal distance for forming the achromatic object glasses of the best telescope, can only be procured by selecting the best among numerous failures, (whence the high price), and modern science has only improved these instruments, by teaching the proper theoretical principles upon which to compound their various parts.

In the above, it is by no means my intention to attempt to detract from the merit of the constructions of our best artists, but merely to shew, that the perfection of modern instruments is due more to the skill by which their parts are contrived and arranged, than to the mechanical skill by which the parts are executed.

It is generally imagined by Native workmen, and by many gentlemen in India, that with a pattern to copy it is easy to make any thing, this is, however, very far from correct; for unless shewn how to do it, it would be as impossible to construct the simplest philosophical instrument, as it would be to copy a telescope, or a chronometer, by the aid of a pattern only.

It is possible, besides, that the country may afford many advantages

for the manufacture of philosophical instruments, which have not yet suggested themselves to me; but among these, prominently occurs to me the opportunity of constructing a superior glass for forming the lens of telescopes, a desideratum, which in England opticians have sought in vain, from the obstacles thereto in the way by the operation of the laws of excise, while in India no obstacles of this kind exist. The materials for making the finest glass are cheap and plentiful, and it is well known, that the famous glass made by M. Ginnund, of which the great Dorpat telescope is constructed, was made in small experiments upon less than two hundred weight of materials at one time.

For making a complete set of philosophical experimental apparatus, India affords all the materials required, with the exception of glass, whence it will be necessary to purchase in London all the glass chemical apparatus for the electrical apparatus, receivers for air-pumps, and for the lenses of the optical apparatus; but as the expense of these articles at the glass-house is but little, it will form probably but a very small item in the outlay.

With the modes of executing the proposed instruments, fitting electrical machines and grinding lenses, I am perfectly acquainted, from having made them for my own use while in England, and from having had the advantage of inspecting, and using the best which have been in London, and from having had the opportunity of seeing the workshops of many of the most eminent philosophical instrument makers.

Rayacottah, 5th October, 1841.

Manual of Chemistry. By Capt. J. CAMPBELL, Assistant Surveyor General, Madras.

PREFACE.

This work was planned several years ago, in consequence of the difficulty which I found in procuring practical information in fitting up a small laboratory for investigations in the Chemical composition of rocks and minerals. Some parts have been for a long time compiled as a set of notes for ready reference, and have been altered and corrected, as further investigations and experience rendered it necessary. It was my intention to have published the part upon Action of Tests, but it was laid aside upon finding that the late Lieut. Braddock of

Madras, had compiled notes for a similar purpose ; his death having unfortunately prevented a revision of his first valuable, though crude, little publication, I have therefore made use of his able abstract of Rose's work, with such corrections and alterations as I considered necessary, and it has been necessary to rewrite nearly the whole.

It was not my intention ever, with my present experience, to have so soon undertaken the authorship of a compilation upon the subject; but having been applied to by the Rev. Mr. Garrett, of the Wesleyan Mission, for a work adapted for the Natives of this country, who might be anxious to acquire an elementary knowledge of chemical science, and finding that Dr. O'Shaughnessy's excellent little Manual was out of print, and there being no work printed in England, at all adapted for the perusal of Natives, I have determined on commencing at once the preparation of a work adapted for the purpose.

As the labour and time required for writing a complete work of this kind would be greater than my pursuits and official occupations would enable me to spare for the purpose, Mr. Garrett has agreed to share with me the labour of compilation, and he has therefore undertaken to draw up the part descriptive of the chemical elementary substances.

While so many excellent treatises upon the different branches of Chemistry exist, no originality can be expected in a work of this kind, and it must be therefore regarded, merely as a compilation of the information from other works, abstracted, condensed, and made as practical as possible.

In endeavouring to lead the Native student on to a general view of the useful application of Chemistry, it has not been forgotten, that the subject may combine with that brief and assorted information which renders the work a "*Manual of Chemistry*," which will be useful, as it is hoped, to those gentlemen in India, who possessing an elementary education upon the first principles of Chemistry, are yet deterred from the practical uses of the science, by the remembrance of the extensive and costly apparatus which they have seen used by their instructors in Europe.

The Native medical practitioner will find a knowledge of this science of the utmost value in assisting him in arriving at a knowledge of the composition of the various mineral productions which the country affords, so as to enable him to ascertain what may be useful to him,

and also enable him to prepare economically and independently of the manufacture in Europe, those chemical preparations which are found so valuable in European medical science. It will enable him to correct and to apprehend the absurdity of many incongruous preparations now ignorantly made use of by Native practitioners, and understand the effects of many which are very mischievous.

A knowledge of Chemistry will enable him to ascertain the quality and properties of the juice of plants, and the decoction of leaves and bark of trees, many of which have been found very valuable in Native practice, and which afford to the skilful chemist a cheap and economical substitute for the more costly chemical preparations employed by Europeans.

It will enable him to prescribe antidotes for the frequent attempts at murder, perpetrated but too often with impunity by poison, among the Native community, upon the slightest personal pique, or feeling of revenge or resentment; but which will receive a severe check from a certainty of detection and conviction, if persons competent to examine into the circumstances were at hand.

To the European amateur, extensive opportunities for the useful and gratifying practices of Chemistry present themselves, with investigations of the mineral resources of the country. In the investigations of the properties and composition of the juices of numerous plants and trees indigenous to this country, but which in Europe cannot be obtained, except in a state of partial decomposition; and the oriental chemist has thus laid open to him a vast field of research, in the pursuit of which he may find the highest gratification, and engross to himself opportunities, which the perhaps more generally skilful chemist of Europe may envy in vain.

If his ambition lead him to seek a higher field, and measure his skill against that of European proficients, there are numerous chemical compounds which have been as yet but imperfectly examined, and upon which his analytical researches may be most usefully employed; while the extensive leisure which many of the officers in the employ of the Government possess, the cheapness of fuel and labour, may enable any one, if he is diligent and enterprising, to seize upon some of those honors which distinguished scientific knowledge has ever received in all countries.

In Europe, where the works of authors are offered for sale, the public have a right to criticise their value, and manner in which the authors have executed their task. In the present case it is far different, the purpose of the work is above criticism, the execution beneath it. The expediency of an attempt to diffuse knowledge will be denied by none, and is indeed the object of the press from which it issues. The imperfections of the execution is a necessary consequence of the limits of the work, and will be attempted to be improved, should public opinion call for another, and more extensive, and of course more expensive edition.

The practical applications of chemical science for the purpose of trade and gain are very numerous.

Carbonate of Soda can be readily and cheaply made by simply crystallizing the solution obtained by lixivating the Soda Earth, (Chour Munnoc,) of the soils of many parts of South India.

Carbonate of Potash can be made by deflagrating Saltpetre with charcoal in an iron pot, (vide description of process under head of Potash from Cocanutt Leaves, Indigo Stocks, &c.)

Prussiate of Potash can be very readily made in India, as well as in England, and as it costs there 7*d.* a pound, and the material required, and the labour are very cheap in India, and the iron pot required easily procured from England, or may be even made in India, it may be made a profitable article of manufacture, (vide description of process of Manufacture.)

Acetic Acid may be made from the decomposition of Wood, (vide process), or by the decomposition of Alcohol by powdered Platina, as Dr. Ure informs us is actually and profitably employed in some parts of the Continent of Europe, where Alcohol is cheap, in converting it into vinegar; it of course can be still more profitably used in India, where Alcohol is still cheaper. Acetate of Soda might be manufactured for importation to England, for the purpose of decomposing it for the manufacture of Acetic Acid, in case the Excise Laws in England should cause a difficulty to the import of the Acetic Acid, or in case Sulphuric Acid cannot be procured at a sufficiently cheap rate in India.

Muriate of Morphia may be readily made in India, for 1-100th part of the price in Europe, as Opium is sold in many parts of India at a very low price.

Indian Steel or Wootz, is very lightly prized in Europe, and the objection to it is the great expense required to fuse it in England, in consequence of the imperfect state in which it is manufactured by the Native workmen, who are ignorant of the principles of the process.

Sulphuric Acid may be made in India much cheaper than in England, because the Sulphur and Saltpetre required are both mineral products of this country, and of course its application in the manufacture of Nitric Acid, Muriatic Acid, and Acetic Acid. In making Chloride of Lime for use in bleaching, in dyeing, &c., and numerous others will follow of course.

Pyroxalic Spirit is another product in the decomposition of wood, which fetches a high price in England, and might be useful for producing light in India, where wood is so plentiful and cheap.

Acetate of Lead is another form in which Acetic Acid might be combined as an article of commerce, (*vide process.*)

Acetate of Alumina is another form in which Acetic Acid might be combined as an article of manufacture of great request in dyeing.

Phosphorous is a product which might be made in India, and afford an instance of the application of Sulphuric Acid.

Citric Acid is very expensive in England, being made exclusively by decomposing an Alkaline Citrate, but which might be cheaply made in India from Limes.

Citrate of Soda or Lime might be cheaply made in India, (*vide process*), and as the fruit is so abundant and cheap, could be made at less expense than Tartaric Acid.

Vinegar cheaply and readily made by the fermentation of a solution of sugar, and as the sugar is so cheap in India, the coarse inspissated juice selling in many places for eight annas per maund, which yields by fermentation — parts of vinegar of the common strength, it can be made for — a gallon.

The Pipe Clay of Arcot, and probably of other parts, affords the means of making Pottery of the finest kind in India.

The Kaolin of Mysore affords the means of making the very finest kinds of Porcelain at little expense, and may be more generally employed in making crucibles and melting pots for metals, or fire bricks for lining furnaces.

Glass also may be an article of manufacture, as the finest kinds of

quartz are abundant in South India; and soda required for a flux and wood-fuel are abundant.

Tartaric Acid may be produced as an article of manufacture by saturating the excess of Tartaric Acid in the [illegible] of the fruit of the tamarind tree with lime, (vide process,) and will be a useful article much required in dyeing; or perhaps the Tartrate of Lime might be introduced into England as an article of commerce.

Alum might be made from the Aluminous Shale said to abound upon the Western Coast.

Prospectus.

Part I. Introduction, Principles of Chemistry, Explanation of Nomenclature.

Sect. 1st. Chemical combination.

Modes of

Solution

Chemical mixture.

Effects of

Change of form.

Change of density or bulk.

Change of temperature.

Alteration of the action of Heat.

Change of Colour.

Sect. 2d. Affinity and tables of,

Sect. 3d. Laws of combination—Atomic.

Theory.

Theory of volumes.

Sect. 4th. Table of equivalents and use of.

Part II. Description of chemical elements and their properties.

Part III. Dictionary of tests.

Part IV. The use of tests, and the practice of quantitative analysis of inorganic substances.

Part V. Description of apparatus.

Part VI. Chemical manipulation, and mode of operation generally.

(Signed)

J. CAMPBELL, *Captain,*

Assistant Surveyor General.

Royacottah, 5th October, 1841.

Report of the death of Mr. CSOMA DE KOROS, made to G. A. BUSHBY, Esq., Officiating Secretary, Political Department, from A. CAMPBELL, Esq. Superintendent, Darjeeling and communicated to the Society.

It is with much regret that I report the death at this place, on the 11th instant, of Csoma de Körös, the Hungarian traveller and Thibetan scholar. He fell a victim to fever contracted on his journey hitherto, for the cure of which he would not be persuaded to take any medicines until it was too late to be of any avail.

Mr. De Körös arrived here on the 24th ultimo, and communicated to me his desire of proceeding to the residence of the Sikim Raja, and thence to Lassa, for the purpose of procuring access to stores of Thibetan literature, which he had been taught to believe, from his reading in Ladakh and Kānsun, were still extant in the capital of eastern Thibet, (Lassa,) and might have thence found their way into Sikim.

As the eldest son of the Sikim Raja is by the usage of the family a Lama, and as the present Tubgani Lama is a learned priest, and said to be in possession of an extensive library, I had some hopes that by making the Raja acquainted with M. De Körös' unobtrusive character, and known avoidance of political and religious subjects in his intercourse with the people of the countries he has visited, I might have contributed to procuring him permission to proceed into Thibet, and to this end I sent the Raja's Vakeel to visit M. De Körös, that he might satisfy himself as to the extent to which he had prosecuted his studies into the language and literature of Thibet, as well as of the objects he had in view in desiring to visit the Tubgani Lama and the city of Lassa. The Vakeel, who is a man of intelligence and some learning, was altogether amazed at finding a *Feringhee* a complete master of the colloquial language of Thibet, and so much his own superior in acquaintance with the religion and literature of that country. I endeavoured to answer his numerous questions about M. De Körös, by detailing the particulars of his early life and later travels in Asia with which I was acquainted; by stating his devotion to the prosecution of his lingual and literary studies; my certain knowledge that in permitting him to visit Sikim and Lassa, the Raja would have nothing to apprehend from ignorance of the usages and religion of the people, or an indiscreet zeal, in the attain-

ment of his objects; that he was not at all connected with the service of our government, or any other power in India; but, that the Governor General had granted him his permission to travel through India, and that any facilities afforded him by the Raja, would be noted approvingly by His Lordship and myself.

The Vakeel at my desire addressed the Raja, explaining fully my wishes, and Mr. De Kőrös resolved to remain here pending a reply from Sikim. He was full of hope as to the favorable result of the reference, and in the most enthusiastic manner would dilate on the delight he expected to derive from coming in contact with some of the learned men of the East, (Lassa,) as the Lamas of Ladakh and Kānsun, with whom alone he had previous communion were confessedly inferior in learning to those of eastern Thibet. He was modest and almost silent on the benefits which might accrue to general knowledge from the results of his contemplated journey, but, "what would Hodgson, Turnour, and some of the philosophers of Europe, not give to be in my place when I get to Lassa," was a frequent exclamation of his during the conversations I had with him previous to his illness.

He had arranged, in the event of his getting permission to proceed, to leave with me all his books, papers, and bank notes to the amount of Rs. 300, to be cared for on his behalf; and a complete copy of the Journal of the Asiatic Society, which he had received from the Society. He said he should ask me to keep in the event of his never returning. How soon were all his enthusiastic anticipations clouded, and his journeyings stopped for ever!

On the 6th instant I called on him, and found him feverish, with foul tongue, dry skin, and headache; I urged him to take some medicine, but in vain. He said he had suffered often from fever and other ailments, from which he had recovered without physic, that rhubarb was the only thing of the sort he had ever used, except tartar emetic. The former had been recommended to him by Moorcroft, and the latter by a Persian doctor. He took out of his box a small bit of decayed rhubarb and a phial of tartar emetic, and said, with apparent distrust in their virtues, "As you wish it, I will take some to-morrow if I am not better, it is too late to-day, the sun is going down." I sent him some weak soup, and returned to see him on the 7th. He was then much better,

got off his pallet, entered into conversation, chatted animatedly with me for an hour on his favourite subjects of thought and enquiry. For the first time since I had seen him, he this day shewed how sensitive he was to the applause of the world, as a reward to his labours and privations. He went over the whole of his travels in Thibet with fluent rapidity, and in noticing each stage of the result of his studies, he mentioned the distinguished notice that had been accorded in Europe and India to the facts and doctrines brought to light by him. He seemed especially gratified with an editorial article by Prof. Wilson, in the Supplement to the Government Gazette of 9th July, 1829, which he produced, and bid me read; it related to the extreme hardships he had undergone while at the monastery of Zemskar, where with the thermometer below zero for more than four months, he was precluded by the severity of the weather from stirring out of a room nine feet square; yet in this situation he read from morning till evening without a fire, the ground forming his bed, and the walls of the building his protection against the rigours of the climate, and still he collected and arranged forty thousand words of the language of Thibet, and nearly completed his Dictionary and Grammar. Passing from this subject, he said, in a playful mood, "I will shew you something very curious," and he produced another number of Wilson's paper of September 10th, 1827, and pointing to an editorial paragraph, desired me to read it first, and then hear the explanation. It run thus: (after noticing some communications to the Asiatic Society from Mr. Hodgson :) "In connexion with the literature and religion of Thibet, and indeed of the whole of the Bhoti countries, we are happy to learn, that the patronage of the Government has enabled the Hungarian traveller, Csoma De Körös to proceed to Upper Busahir to prosecute his Thibetan studies for three years, in which period he engages to prepare a comprehensive Grammar and Vocabulary of the language, with an account of the history and literature of the country. These objects are the more desirable, as we understand Mr. De Körös considers the recent labours of Klaproth and Remusat, with regard to the language and literature of Thibet as altogether erroneous. Mons. Remusat, indeed, admits the imperfectness of his materials, but Klaproth, as usual, pronounces *excathedra*, and treats the notion of any successful study of Thibetan by the English in India with ineffable con-

tempt." "Now I do not recollect," said Mr. De Kőrös, "that I gave my opinion of Klaproth as it is given here, but oh ! Wilson was very, very," and he shook his head significantly, "against Klaproth ; and he took this opportunity to pull him down, and favour Remusat. It is very curious ;" and he laughed heartily. Not being of the initiated in the curiosities of Thibetan literature, I did not fully appreciate the jest ; but others probably will, and I was greatly interested with the keen enjoyment produced in the mind of the Ascetic, by this subject.

At the same visit, he produced "*Hodgson's Illustrations of the Literature and Religion of the Buddhists*," and asked me if I had seen it ; on being told that I had a copy, and had been familiar with its contents in progress of collection, although unversed in the subject ; he said, "He sent me this copy ; it is a wonderful combination of knowledge on a new subject, with the deepest philosophical speculations, and will astonish the people of Europe ; there are however some mistakes in it." I think he then said, "In your paper on the Limboos, you asked if the appellation 'Hung,' distinctive of families of that tribe, had any reference to the original 'Huns,' the objects of my search in Asia. It is a curious similarity, but your 'Hungs' are a small tribe, and the people who passed from Asia, as the progenitors of the Hungarians, were a great nation." I replied, that as the original country of the Limboo "Hungs" was undoubtedly north of the Himalaya, and as he believed the same to be the case as regarded the "Huns," it was at all events possible, that the "Hungs" of this neighbourhood, might have been an off-shoot from the same nation. "Yes, yes," he rejoined, "it is very possible, but I do not think it is the case." And then, as if preferring to luxuriate in remote speculations on his beloved subjects rather than in attempting to put an end to them by a discovery near at hand, he gave a rapid summary of the manner in which he believed his native land was possessed by the original "Huns," and his reasons for tracing them to Central or Eastern Asia. This was all done in the most enthusiastic strain, but the texture of the story was too complicated for me to take connected note of it. I gathered, however, from his conversation of this day, and of the previous ones since our acquaintance, that all his hopes of attaining the object of the long and laborious search, were centred in the discovery of the country of the "Yoogars." This land he believed to

be to the east and north of Lassa and the province of Kham, and on the western confines of China ; to reach it, was the goal of his most ardent wishes, and there he fully expected to find the tribes he had hitherto sought in vain. The foundation of his hopes, to any one not deeply imbued with enthusiasm, or accustomed to put faith in philological affinities, will probably appear vague and insecure. It was as follows, in so far as I could gather from his repeated conversations. In the dialects of Europe, the Slavonic, Celtic, Saxon, and German, I believe, the people who gave their name to the country now called Hungary, were styled Hunger or Ungur, Oongar, or Yoongar ; and in Arabic, Turkish, and Persian works, there are notices of a nation in Central Asia, resembling in many respects the people who come from the East into Hungary. In these languages, they are styled Oogur, Woogur, Voogur, or Yoogur, according to the pronunciation of the Persian letter, and from the same works it might be inferred, he said, that the country of the "Yoogurs" was situated as above noted. There were collateral reasons which led him to this conclusion, but he did not lay much stress on them, and they have escaped my memory. It has since occurred to me, that at the time of the conversations now detailed, Mr. De Körös had some presentiment that death was near him, for on no former occasion was he so communicative, nor did he express opinions, as if he was very anxious they should be remembered. On this day he certainly did so, and I feel it due to his memory to record them, even in this imperfect manner. To give his opinions point, it would require a knowledge of the subjects on which he discoursed, to which I cannot pretend ; yet such as they are, they may, as the last words of an extraordinary man, be prized by those who honoured him for his acquirements, and admired him for his unwearied exertions in the cause of literature, languages, and history.

Although so much better on the 7th than on the previous day, I dreaded that a return of fever was impending, and I again urged him to take medicine, but in vain. On the 8th I did not see him, but on the morning of the 9th, on visiting him with Dr. Griffith, I found that fever had returned ; he was confused, and slightly delirious ; his countenance was sunken, anxious, and yellow, and altogether his state was bad and dangerous. After much trouble, we got him to swallow some medicine,

and had his temples rubbed with blistering fluid. On the morning of the 10th he was somewhat better, but still unable to talk connectedly or distinctly; towards evening he became comatose, and continued so until 5 A. M. of the 11th, when he expired without a groan or struggle. On the 12th at 8 A. M. his remains were interred in the burial ground of this station. I read the funeral service over him, in the presence of almost all the gentlemen at the place.

The effects consisted of 4 boxes of books and papers, the suit of blue clothes which he always wore and in which he died, a few shirts and one cooking pot. His food was confined to tea, of which he was very fond, and plain boiled rice of which he ate very little. On a mat on the floor with a box of books on the four sides, he sat, ate, slept, and studied, never undressed at night, and rarely went out during the day. He never drank wine or spirit, or used tobacco or other stimulants.***

Annexed is a detailed list of the contents of the boxes. Among his papers were found the bank notes for Rs. 300, to which he alluded before his death, and a memorandum regarding Government Paper for Rs. 5,000, which it is stated in transcript of a letter to the Government, dated 8th February, 1842, it was his wish to leave at his death to the Asiatic Society of Bengal for any literary purpose. Cash to the number of Rupees 224 of various coinage, and a waist belt containing 26 gold pieces, (Dutch ducats I believe,) completes the money part of his effects. From this I shall deduct the funeral expenses and wages due to his Lepcha servant, and retain the remainder, along with the books and papers, until I receive the orders of Government for disposing of them. As the deceased was not a British subject, I have not made the usual advertisement of the possession of his effects, nor have I taken charge of them in the Civil Court, but in my capacity of Political Officer in this direction.

From a letter of James Prinsep's among the papers, I gather that he was a native of the town of "Pest," or Pesth, in the province of Transylvania, and I have found transcript of a letter addressed by him to the Austrian Ambassador in London, apparently on matters connected with his native country; I presume therefore, that the proper mode of making his death known to his relations, if such there be, and of disposing

By
Frederick Bedford H. H. Service

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(Signed) F B

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of the money not willed by him, will be through the Austrian Ambassador at the British Court. In some documents I found his address to be "Korasi Csoma Saudor."

I have the honor to be, &c.

(Signed) A. CAMPBELL, *Superintendent.*

NOTE.—I may add to Mr. Campbell's interesting paper such confirmation as my memory enables me to give of the opinion held by the deceased philologist on the origin of the Huns, which with singular opinions on the Boodhist faith, constituted his most favourite speculations. He on more than one occasion entered on the subject with me at great length, detailing in particular the *Sanscrit* origin of existing names of places and hill ranges in Hungary: my constant request at the close of these conversations used to be, that he would record these speculations. He invariably refused, alluding darkly to the possibility of his, one day, having it in his power to publish to the world something sounder than speculation. In proportion as I pressed him on the subject, he became more reserved with me on these particular questions. He seemed to have an antipathy to his opinions being published. I remember his giving me one day a quantity of curious speculation on the derivation of geographical names in Central Asia. Some months afterwards, I had occasion to annotate on a theory of the nomenclature of the Oxus, and writing to him, recapitulated his opinion on the subject, and begged to be allowed to publish it by authority. His answer was, "that he did not remember." His exceeding diffidence on subjects on which he might have dictated to the learned world of Europe and Asia, was the most surprising trait in him. He was very deeply read in general literature, independently of his Thibetan lore; but never did such acquirements centre in one who made such modest use of them.



Note to accompany a Map of the Isle ST. MARTIN'S. By C. B. GREEN-LAW, Esq., Secretary to the Marine Board.

It is some time since the annexed map of a Survey of the Island of St. Martin's, south of the River Naaf on the Arracan Coast, has been prepared for publication in the Journal. It is by the late Mr. Frederick Bedford, who commanded a schooner employed on that Coast for the prevention of salt smuggling.

The survey of this and other islands and places on the Coast, formed no part of the established duties of Mr. Bedford's office, but he undertook them and executed them with a zeal and spirit that won for him the good opinion of his immediate superiors in the province, and with an ability which would assuredly have obtained him the future support and

countenance of the Government, had he lived to carry on the further surveys which were in contemplation.

Unfortunately, however, the *Osprey*, the beautiful schooner which he commanded, was lost on the night of the 15th of November last in a gale of wind.*

The survey of St. Martin's Island, however, formed but a small portion of what he had already performed. He made a similar survey of Oyster Island, and of the mouth of the Myoo River, and his maps and charts formed part of a lengthened Report from the Commissioner of the province, Captain Bogle, on the propriety of establishing a regular chain of lights on the coast. I have no purpose, however, to go into that extensive question, although in connection with the increasing prosperity of the province, arising from its rapidly increasing growth and export of rice, as also with the consideration of the probable eventual establishment of a naval port at Kyouck Phyoo, it is an interesting, if not an important question.

My present remarks are necessarily confined to St. Martin's Island, and in addition to what is stated by Mr. Bedford in the sketch itself, in respect to the nature of the soil, I am enabled to add the following from the Commissioner, who says, I think justly, that this Island appears to be capable of being turned to profitable account.

Captain Bogle, after adverting to Mr. Bedford's remarks on the best position for a Light House, observes,

"It is not only as a light house station that this Island appears to be deserving of attention ; as a Sanatorium for the people of Calcutta, it would I have no doubt be found invaluable ; it cannot be at all subject to the evils of the climate of Arracan, for it is too far north, and is besides six miles from any land ; it is about four miles long by one mile broad at the north end ; it has plenty of excellent fresh water ; turtle, and doubtless oysters abound ; the sea around it supplies large quantities of the finest fish ; the soil is in part excellent, probably well adapted to the growth of vegetables ; it possesses some pretty undulating scenery, the northern portion of the Island being a perfect park ; there is space

* It appears that the *Osprey* left the Naaf on the 15th of November, and has not since been heard of, but as a sudden and severe gale occurred during the night, there is no doubt she foundered. He himself had only on the 9th of the same month written, that she was as fine a craft as could be, and that he considered her equal to any service.

for ten or twelve bungalows with compounds, as well as for Natives' houses. The beach affords a beautiful ride and splendid sea-bathing, and in the N. E. monsoon, the climate is superlatively fine, as it must also be in the months of March, April and May, when the sea breeze blows most refreshingly ; in short, it is described as a very agreeable Island, and one which owing to its proximity to Calcutta, and its remoteness from external evils and temptations, might possibly be found a most admirable location, not only for the higher classes, but for European invalid soldiers."

I can add nothing to this very interesting, though simple notice of Captain Bogle, beyond the expression of my hope, that some parties may be found sufficiently enterprizing to make trial of the capabilities of the Island, bearing in mind, that there is a regular established intercourse between Calcutta and Arracan by means of the *Amherst*, and that therefore there would always be periodical opportunities of coming and going ; add to which, it is to be hoped, that another vessel will shortly be sent to take the place of the ill-fated *Osprey*, which by her visits would help to enliven the place, and add to the means of communication.

On the Cotton called "Nurma," by Dr. IRVINE, Residency Surgeon at Gwalior. Communicated by COLONEL SPIERS, Resident at that Court.

I have the honour to forward to you the result of my inquiries regarding the Nurma cotton, which I have only now been able to complete. I send the information I have obtained in the form of question and answer.

I beg to call your attention to the fact, that Nurma is the name applied to this cotton by the Mussulmans only ; and that the real name from time immemorial is "*Burari*," and that it is in all probability indigenous. The Nurma is not produced as a crop at Chanderee, but is imported as required from Cholai Muhasur on the Nerbudda, where it is regularly cultivated.

A few years since, an experiment was tried at Chanderee of growing the Nurma cotton, but as the cotton yielded was not so good as that imported, and as insects and frost injured the plants, and as the cotton adhered very firmly to the seed, the ryots at once gave up their inten-

tion of cultivating the Nurma plant. This abandonment seems to have been very premature; as it is most likely that a little more care and perseverance would have insured success. The present demand for Nurma cotton is, however, so very small, the trade in fine Mamoodies being little or none, that no encouragement is afforded to the cultivators. The present supply of Nurma cotton from Cholai Muhasur at Chandree has been five years in the godowns there, and is far from exhausted, and can be had there at three seers per Chanderee rupee.

It will be observed, that the Nurma cotton is naturally of a dirty yellowish colour; it is also gathered very carelessly; the wool adheres strongly to the seed; and the fibre though fine, is not long in the staple. It is vastly inferior to Sea Island cotton in every respect.

I take the liberty of sending another specimen of common American cotton grown by me at Gwalior last rains. This cotton, it will be seen, is finer, and in every respect better than the Nurma cotton; the Chanderee people themselves say so, and this common American cotton can easily, under proper treatment, be introduced into India. The Nurma cotton can no doubt be spread over the country in suitable places; but it will never equal the American cotton. The fineness of spinning is no criterion, as the invisible thread of Chanderee has been far surpassed by the Manchester machine spinning, where one pound of the best cotton has been extended to 8 skeins of 180 yards each, but this degree of fineness is not a desideratum in England, and has been effected only as a curiosity.

The labour, delay, and expense of the Chanderee Mamoodie manufacture of any degree of fineness is exceedingly great. The finest Mamoodie piece of five yards costs Chanderee rupees 100; the breadth being only half a yard, while for this sum ten pieces of fine Scotch Cambric can be purchased even up-the-country of beautiful even texture, 7 yards long and a yard wide.

The greatest trouble and time is taken in collecting skeins from the different spinners of equal fineness.

1st Query.—What is the kind of cotton called Nurma; is it of this country or foreign; and if foreign, in what way has it been introduced; who brought the seed first, and from what country?

1st Answer.—Nurma cotton is foreign according to universal belief at Chanderee; has always been brought to Chanderee from Cholai Ma-

hasur beyond Kidore on the Nerbudda; the best Nurma cotton is alone brought from that place. The Cholai Muhasur seed has on one occasion been sown at Chanderee as an experiment, and though the cotton produced was fine, it was not at all equal to the real Nurma cotton of Cholai Muhasur. The inhabitants of Chanderee have no idea of the time of the introduction of Nurma cotton into India. For the last 25 years, the present fineness of thread has been spun; formerly the thread spun was so very fine as to require a blanket on the ground moistened to receive it as it came from the wheel, when the thread was scarcely visible; and it is said, that a skein placed loosely in a saucer of water, might have been drank unknown to the person swallowing it. Mussulmans and Hindoos of all classes equally employ themselves in spinning this cotton. Nurma is the name given by the Mussulmans; the real name from time immemorial is "*Burari*," which would indicate Berar as the original country of this cotton; or the word may have arisen from the cotton drawing easily out into a thread, from "*burana*," to draw out.

2nd Query.—Is Nurma cotton produced in the common fields, or does it require peculiar ground and treatment?

2nd Answer.—Nurma cotton has always been imported into Chanderee, and has only once been sown there about five years ago. The Nurma seed was sown at the villages of Keerawul and Sersode, four miles from Chanderee; the cotton produced was not so good as that of Cholai Muhasur, the crop was besides injured by insects, the ryots therefore did not sow it again. It appears, however, evident, that the Nurma cotton would succeed about Chanderee, but there being very little demand, there is no encouragement. At present Cholai Muhasur supplies amply more than is required at Chanderee. As stated, three beegahs were sown at Keerawul, and two beegahs at Sersode, and the cotton produced, though fine, was like common country cotton in adhering firmly to seed, and hence was rejected by the spinners. The soils at these villages are light brown loams. In these native experiments, the Nurma seed was sown in the same way as the common country cotton. After the first rain in June, the ground was ploughed, then allowed to imbibe a heavy shower, the seed was then sown, then harrowed with the wooden "*putela*," then exposed to a few days' rain, after which the young plants were weeded by the hand, the

ground was then hoed, after which common manure was spread over the field by the hand amongst the plants, the weeding and hoeing were repeated at intervals several times. The crop was nearly destroyed by small insects, and by frost. The Nurma cotton produced at these villages on this occasion, required the seed to be separated from the cotton by the *churkee*, or rollers; while the seed of real Nurma cotton from Cholai Muhasur is easily and immediately separated from the seed, merely by rolling it lightly with a wooden pin, or by picking it with the hand.

3rd Query.—Do the natives largely manure the fields for Nurma cotton; and is a peculiar manure used?

3rd Answer.—This I have written to inquire at Cholai Muhasur.

4th Query.—At what season is Nurma cotton sown, and in what manner; when is the crop ready, and after gathering, how is it cleaned?

4th Answer.—After the first fall of rain in June, in the same method as country cotton. The crop is gathered about October or November at seven or eight intervals, according to the favourableness of the season, and is cleaned by the hand, or a small wooden rolling pin. The cleaning is evidently very much neglected, as the Nurma cotton is brought from Cholai Muhasur in the same dirty state as the specimen sent. Before spinning, the Nurma cotton is pulled out for six hours by the fingers, and then is drawn out and dusted by a small apparatus, (or "*pinjurs*,"") of a catgut thread struck by a mallet, and is then rolled on small sticks, from which it is placed in paper sheaths to spin off, each sheath having a leather wrapper to give a firm hold, and also to prevent the perspiration soiling the contained cotton. It is spun by very small wheel, having a very fine spindle.

5th Query.—What is the price of the best Nurma cotton, and to what country is it exported?

5th Answer.—Formerly as there was a great demand at Chanderee, and as the supply from Cholai Muhasur was in a degree limited, the Nurma cotton cost Chanderee rupee 1 per seer; now the demand has so greatly fallen off, that three seers can be had for the same sum. This cotton is alone imported to Chanderee from Cholai Muhasur; it is not known to be imported into any other place; for several years Nurma cotton has not even been brought to Chanderee; the finer cotton Mamoodies being in very little demand, the trade has vastly diminished. Rich

natives only make inquiries for this fine cloth, which is sold in a very few shops. The Nurma cotton of which these Mamoodies are now made, has been in the Chanderee godowns for five or six years past, and does not spoil by keeping.

6th Query.—How many years does the Nurma cotton remain in the soil?

6th Answer.—One year only.

7th Query.—What soils are deemed the best for the Nurma cotton? Specimens of the soils are required.

7th Answer.—The light brown loams are deemed the best cotton soils. The Sersode soil is only sent; one specimen from the surface; one from 8 inches deep; one from $1\frac{1}{2}$ feet deep.

8th Query.—The nature of the soils and minerals around the cotton fields?

8th Answer.—These specimens for reasons stated have not been brought.

9th Query.—Are the Nurma cotton fields watered or not; and if watered, how often?

9th Answer.—They are never watered, being left solely dependent on the rains.

10th Query.—When the Nurma cotton plants are about to flower, are the tops broken off or not?

10th Answer.—The plants are always left in their native luxuriance.

11th Query.—A specimen of Nurma cotton is required.

11th Answer.—The specimen of Nurma cotton is one imported at Chanderee from Cholai Muhasur; there is also a specimen of the deteriorated Nurma cotton from seed, as stated, sown at Chanderee.

12th Query.—When the Nurma crop is ripening, is the plant liable to disease?

12th Answer.—The Nurma plants produced at Chanderee were much injured by insects and by frost. The insects were like those moths that destroy woollen cloths.

13th Query.—When the fields of Nurma cotton produce plentiful crops, what tax is paid per beegah?

13th Answer.—From eight annas to one rupee a beegah, as for other crops.

14th Query.—At Chanderee how deep are the wells, and in what stratum is water found?

14th Answer.—About forty cubits deep the water is found in sandstone: the water is excellent.

15th Query.—Specimens of the thread of which the fine Mamoodies are made are required?

15th Answer.—Two skeins or "*pucheries*" of the thread are sent, the finest weighs $2\frac{1}{4}$ mashas, and costs 4 annas; the coarser weighs $2\frac{3}{4}$ mashas, and costs $3\frac{1}{2}$ annas; one of these "*pucheries*" cannot be spun in less than four days. They are spun by all parties, and when collected, are arranged according to their fineness.

GWALIOR, March 17, 1842.

NOTE.—My readers may recollect, that "Nurma" cotton from the neighbourhood of Herat, was one of the samples of the staples of trade between Sind and Khorasan, and that "the foreign origin" of the Nurma grown in Bundelkhund was then accounted for by me by the natural supposition, that the fine cotton was brought into the country by the early Mussulman invaders; an opinion which I still adhere to. H

On a Cylinder and certain Gems, collected in the neighbourhood of Herat by Major Pottinger. By the EDITOR.

I have selected the gems figured in the annexed plate from among a collection placed in my hands by Major Pottinger. The cylinder (Fig. 1.) is a very curious relic indeed. It was found on the hills close to Herat by an Eimauk woman, from whom, I believe, Major Pottinger purchased it. The material of which it is composed, as well as the figures, and Cuneiform characters upon it, having equally baffled conjecture and ordinary investigation, I sent the impression, taken in sealing-wax, to Major Rawlinson at Candahar, requesting him, acquainted as he is with some of the forms of the Cuneiform character, to give me his opinion upon it; while I applied to my friend, Mr. Piddington, now Curator of the Geological branch of the Museum of the Asiatic Society, to determine, if possible, the material of which the cylinder was composed. His opinion, in which Professor O'Shaughnessy concurred, was given me as follows:—

"At the request of our Secretary, I have examined this precious relic as to its physical properties. Its dimensions are,

	Inches.					
Height,	1.1
Diameter,	0.5
Diameter of the hole,	0.2

“The hole is not drilled through the exact centre, and, as may be seen by looking into it, has been drilled from opposite ends. Its hardness is very considerable, as a good file will scarcely touch it. It is magnetic, but not strongly so, and its spec. grav. by two trials at a temperature of 82° is 4.97. Neither nitric nor muriatic acids produce any effect on its surface. Its colour is a dark black grey, with minute shining specks, (probably of magnetic oxide of iron or mica,) only seen in a strong light, or by a magnifier.

“As it is by far too valuable to take even the minutest portion for a blowpipe analysis, I am deprived of any farther means of ascertaining what it can be. Its high specific gravity places it far out of the class of basalts, to which it would at first be referred on a cursory inspection; and its hardness out of the magnetic iron ores. I am inclined to think it a ferruginous titanite, analogous to that described by Klaproth from Aschaffembourg, in Silesia. Perhaps, though not exactly a physical property, I should not omit to remark the admirable sharpness of the characters, which it is doubtful any metallic tool could have produced.

“I add here from the London translation of 1801 of Klaproth’s Essays, p. 504, the chemical characters of his fossil :—

‘*Colour*.—Iron black, accompanied outwardly by a moderate, inwardly by a stonger, metallic lustre.

‘*Fracture*.—Uneven and of a fine grain; fragments indeterminately angular.

‘*Hardness*.—Very brittle and hard, and only with difficulty ground to a subtle powder, which is black.

‘*Specific Gravity*, 4.74.—(This was probably at 60° .)

‘*Magnetism*.—Not attracted by the magnet even in the small splinters, nor does it attract the least particle of iron. The more remarkable is it, therefore, that it attracts and repels the poles of the magnetic needle, or any moveable magnetic bar.

‘*Composition*.—Oxyde of Iron, 78. Oxyde of Titanium, $22=100$.’

“So far Klaproth. I may add, that the degree of magnetism which he here describes, is that which our cylinder also possesses, and which is now well known to be merely an inferior degree of the same element.”



The character Major Rawlinson informs me, is the third, or mixed order of the Cuneiform writing. He supposes the inscription to express some formula of prayer, or adjuration. The cylinder being evidently an amulet to be worn suspended round the neck, or the arm, or perhaps

on a string round the middle, as with the amulets of a somewhat similar shape worn by children in this country, his conjecture is in all probability correct. The figures and emblems on the cylinder have yet to be explained. The man holding a dagger, is perhaps in the act of binding himself to some compact, religious or civil, the conditions of which are expressed in the inscription in the presence of a priest, some emblem having reference to the rite, being apparently the image of a bird, being set up between the two? Or is the supposed priest in the long striped robe a female figure? I have taken much pains to arrive at even a plausible conjecture respecting the upright emblem, as a clue would be readily found to the meaning of the whole, could this type be traced. All I can say on the subject is, that such an emblem is figured in Rich's Memoir on the Ruins of Babylon, in No. 1. *a.* of the plates which illustrate that interesting notice. "No. 1," says Mr. Rich, "is a black stone of an irregular shape (in part broken and defaced,) about one foot in length, and $7\frac{1}{2}$ inches in breadth. The figures on it *a* and *b*, have been supposed to represent the Zodiac of the Babylonians;" an inscription is partly legible, I should observe, on the stone, written in the first form of Cuneiform writing. The figures on the stone (*a*) are those of a dog, or wolf, and of a bird seated upon a staff or rest, set upright in the ground. The shape and attitude of the bird would incline one to conclude that the artist intended to represent a crow or raven. The idea that the emblem is Zodiacal, is, I think, borne out by the nature of the figures on (*b*), the other part of the same stone, which represent an antelope, a human head with ram's horns, an altar, two human figures, and others which are indistinct. I am more impressed with the theory of the Zodiacal character of the bird emblem, from having found it with other similar figures, in a plate Vol. II. of Kerr Porter's Travels.

I have by me drawings by the late Edward Conolly of several similar rude figures of birds, of which he gave me the following notice: "These are from Seistan; these small copper images are however found in the ruins of old cities in all parts of this country, and have been dug out of topes." Mr. Rich observes, "small figures of brass or copper are also found at Babylon:" (?) of a similar description with the above. (?)

This suffices to establish the fact, that such an image as that figured on the cylinder, was for some purpose as yet unknown to us, but having reference, probably, to a religious rite, in common use among the ancient

Parthian (?) inhabitants or invaders of Khorassan. Even this meagre index to a solution of the meaning of the type might give an able antiquary the means of following up the investigation with success.

The cylinder, figured No. 12, in Rich's Memoir of the Ruins of Babylon, differs from that before us as respects the inscription, but with regard to the human figures, is precisely the same. The priest in the striped robe, with his arms raised in the manner (vide Kerr Porter's Travels,) depicted on many of the ancient Persepolitan sculptures, the man with the dagger, as if in the performance of a rite, are exact in the one as in the other; the emblem between these figures is however different from our's; it is also  differently placed, and not as standing on the ground; it is in this shape, while the indistinct emblem, which is given in our's  above the heads of the figures, is replaced in Rich's by a directly solar type, as I conceive it to be.



This variation in the emblems may account for the inscription of a different written formula. Mr. Rich's brief notice of these curious relics, I extract for readier reference.

"The Babylonian cylinders are among the most remarkable and interesting of the antiques. They are from one to three inches in length: some are of stone, and others apparently of paste, or composition of various kinds. Sculptures from several of these cylinders have been published in different works; and Nos. 10, 11, 12, 13, and 14, are specimens of my own collection. Some of them have Cuneiform writing on them, (as Nos. 12 and 13,) which is of the third species; but has the remarkable peculiarity, that it is reversed, or written from right to left; every other kind of Cuneiform writing being incontestably to be read from left to right. This can only be accounted for, by supposing, that they were intended to roll off impressions. The cylinder No. 11, was found in the site of Ninevah. I must not omit mentioning in this place, that a Babylon cylinder was not long ago found in digging in the field of Marathon, and is now in the possession of Mr. Fauvel of Athens. The cylinders are said to be chiefly found in the ruins of Jerbouiya. The people of this country are fond of using them as amulets, and the Persian pilgrims, who come to the shrines of Ali and Hossein, frequently carry back with them some of these curiosities."

Having done my best to offer some explanation of this curious relic, I have, *with inexpressible regret* to state, that it is no longer in my posses-

sion ; a friend to whom I entrusted it, for the purpose of examination, having mislaid, or lost it.

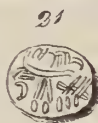
My readers will at once detect on Fig. 2, characters similar to those of Conolly's gem of *the hand and ear*, noticed by me in No. 122 of the *Journal*, and of other gems already published in this *Journal*. They are boldly and elegantly cut, as are also the wild goat's head, and the palm leaves (?) which complete the device. The gem is on basalt, which has been cut down to form a surface for the execution of the carving. The whole has then been roughly polished, and the stone drilled, to allow of a string or ribbon being passed through it. The perforation so made, is about a third of an inch in diameter, and is cut in a clean and workmanlike manner. Its large size, compared with that of the gem itself, is perhaps indicative of the value attached to the amulet, its wearer being desirous of securing it by as strong and thick a ligature as possible ? I conjecture the device to have some planetary allusion. Might one suppose it zodaical, and detect Capricorn in the goat's head ? It is given in its full size in the plate, but without a side view, which would have shewn the perforation, and the whole bulk of the gem.

No. 3.—Is on crystal, the head Sassanian ; a variation of the characters (?) the execution good.

No. 4.—Red cornelian, a man driving before him a humped bull. The characters are indistinct, and the execution coarse : the reverse of the gem plain and highly polished.

No. 5.—Sardonyx, the characters similar to those of No. 2, and beautifully executed. I fail, however, entirely to make out what the central object is intended for ; a conch shell ? This stone by its shape and size, appears to have been intended for a seal ring.

No. 6.—Red cornelian, it is carved on both obverse and reverse, and carefully polished : the former slightly convex, the latter flat. The character is evidently the ancient form, used for the earliest Pali inscriptions. My Pundit, Sarodha Prasad, professes to read the reverse in Pali, **महामहिमगसमादेश** which rendering Pundit Kamala Kanta concurs in. The obverse is perhaps the abbreviated form of some ordinary mandate, as the characters appear arbitrary, and the meaning of the reverse, (as read by the Pundits,) *maha mohe maga samadesh*, carries out the inference, it being, "command of him who is first in dignity." (?) I give the



reading (*quantum valeat*) on their single authority. If it is a correct one, we have before us the signet of some bye-gone potentate, who used it to authenticate his written orders.

In the numbers which follow, I have given specimens of the ruder and *unlettered* gems found in numbers in Khorassan, as in the upper part of the plate are shewn various descriptions of *lettered* gems from the same quarter, giving inscriptions in *three*, if not *four*, of the forgotten languages of the earth.

No. 7.—Pink cornelian : it is roughly polished, and drilled for threading. The subject, a stag with branching antlers, is perhaps the commonest among the devices on such gems. Nos. 10, 14, 17, and 22 give proof of it. A solar type is perhaps intended.

No. 8.—Red cornelian : a lion very coarsely cut, the stone however is carefully shaped and polished.

No. 9.—Crystal : the subject (?)

No. 10.—Fine red cornelian, highly polished ; apparently a flower.

No. 12.—Red cornelian : a humped bull ; this stone is rudely perforated.

No. 13.—Crystal : a horse rudely cut on the convex side of the stone.

No. 14.—Pink cornelian.

No. 15.—Ditto, the stone rudely perforated : the subject (?)

No. 16.—Ditto : a bull.

No. 17.—Veined brownish cornelian : the stone has been ground down to form a surface, and is roughly perforated.

No. 18.—Serpentine : a mounted horseman.

No. 19.—Crystal.

Nos. 20, 21, 22, 23.—Red cornelian : all these gems are merely given as specimens of the rude emblematic devices found in numbers about the sites of ancient cities in Khorassan.

No. 24.—Is a lump of white agate, rudely ground down in one place for the reception of the device, and as rudely perforated. A *Jotee*, or Jain priest, who saw this gem, professed to recognize a Buddhist emblem in it, declaring it to be the conventional mode of representing the *sruthi sthaponi*, or desk-frame from which the Buddhist scripture is read : he brought me an ancient Pali illuminated inscription to prove his assertion, by pointing out to me a similar device ; but by no means succeeded in convincing me of the resemblance. The supposition is however perhaps worth mentioning.

Museum of Economic Geology of India. By H. PIDDINGTON, Esq.

SIR,

I am authorised by the Committee of Papers of the Asiatic Society, to forward to you the accompanying Memorandum relative to the MUSEUM OF ECONOMIC GEOLOGY OF INDIA now forming, in the confident hope that you will personally, and through your friends, kindly assist their views and those of Government, as far as lies in your power.

With respect to carriage of Specimens, such small ones as may not exceed the usual dawk banghy weight, say 500 Tolas, may be sent at once, addressed to the Secretary of the Asiatic Society, and those above that weight dispatched by the nearest water carriage, preferring the Steamers if obtainable.

I am, Sir,

Your obedient Servant,

H. PIDDINGTON,

Curator, Mus. Econ. Geology of India.

CALCUTTA,

184 .

The objects of the Museum of Economic Geology of India, which has been established by Government at Calcutta, under orders from the Hon'ble the Court of Directors, in conjunction with the Asiatic Society and at its Rooms, are the following: They are, as scientific men will perceive, generally those of Economic Geologists in all countries, but there are some peculiarities connected with India, and the situations of Europeans in it, which will oblige us to go into a little detail, to explain to those who may not already take an interest in these matters, our wants, our wishes, and our hopes of the advantages which may accrue to the community from this new establishment. Its objects then are briefly these:—

1. To obtain the most complete Geological, Mineralogical, and Statistical knowledge possible of all the mineral resources of India, wrought or unwrought, so as to make them as publicly known as possible; to shew how they have been, or are now wrought, or how they might be so to the best advantage.

2. To obtain a complete set of specimens, models, and drawings, relative to the Mining operations, Metallurgical processes, and Mineral manufactures of all kinds, of India and of Europe and America; so as to afford to the public information of every thing which can be turned to account here or in Europe, and perhaps prevent loss of time, waste of capital, and disappointment to the Indian speculator.

3. To furnish the Engineer and Architect with a complete collection of all the materials, natural or artificial, which are now, or have formerly been used for buildings, cements, roads, &c. and of all which *may* possibly be useful in this department, whether European or Indian.

4. To collect for the Agriculturalist, specimens of all kinds of soils remarkable for their good or bad qualities, with the subsoil, subjacent rocks, &c. and by examination of these, to indicate their various peculiarities and the remedies for their defects.

5. To collect for Medical men, the waters of mineral springs, mineral drugs, &c. &c.

6. And finally, by chemical examinations of all these various specimens, to determine their value, and how they may be best turned to account for the general benefit of the community.

With objects like these the Museum of Economic Geology may be said to be placed between the purely scientific geologist and the merchant, the miner, the farmer, the manufacturer, and the builder, or in other words, the merely practical men, who may desire to know how the knowledge of the geologist and mineralogist,—to them often so recondite, and apparently so useless,—can forward their views: and its office, to be, if possible, to answer all questions of this nature which may arise, for public benefit.

This may sometimes to be done from books, but the great library must be the collections of our Museum, which are in fact a library of examples, to which the commentary is the laboratory; where, aided by the resources of the collection, questions may often be solved in an hour, a day, or a week, which it would take half an *Indian* life to obtain the mere materials for investigating. An extensive collection, then, is the first requisite, and this should, if possible, comprise every inorganic product of the earth from which mankind derive any advantage, with every information relative to it. It will readily occur to the reader, that in India, owing to her infancy in some of the arts dependant on these products, as in mining, agriculture, &c.; and her singular progress in others, as in peculiar branches of Metallurgy and the like, our almost absolute ignorance of what her methods and resources are, the peculiarities of situation in which these resources may exist, those of climate, workmen, and many others, we have almost every thing yet to learn; and that to accomplish our objects, we cannot be too well furnished with all the knowledge and examples of Europe and the Americas, and all those of India, or of Asia. Without these, our progress must be very limited; but in proportion as we obtain them, we may hope, without presumption, to see the day when the mines, the quarries, and the soil of India may be done justice to, which assuredly, has never yet been the case.* In this all classes are so clearly interested, that it would be superfluous to shew it, as it is to shew that the resources of every country are far more readily developed with public means for investigating, preserving, and publishing all knowledge belonging to them, than where none such exist.

It is therefore hoped, that those who may be desirous of assisting this great public work, will bear in mind, that nothing, however familiar it may be to those on the spot, is indifferent to us; for *if not wanted for the institution, it may serve to procure that which is*; and the following note is given rather as a general memorandum than as specifying all which is desired. The general rule is, that details cannot be too numerous, nor specimens too various, particularly if purely Indian.

* It is curious to find that upwards of 140 years ago, the ores of the precious metals were an article of export from the Dutch East Indies! This is clearly shewn by the following passage from Schlutter's work, as translated by Hellot, and published by him under the title of "*Hellot sur les Mines*," Paris, 1753. In Vol. II. p. 285, Chap. XLVI. "*On East Indian Ores and their Fusion by the curved Furnace*," he says—

"In 1704, Schlutter received by a private channel twenty-five quintals of ore from the East Indies, &c." And again: "These sorts of ores (of gold and silver) sent from India by the Dutch were frequently smelted at the foundry of Altenau in the Upper Hartz, but had never been smelted in the Lower Hartz. This ore was in lumps from the size of a nut to that of walnut, and by trials it was found that the quintal of 110lbs. contained 1 oz. 8 drs of gold and $3\frac{1}{2}$ oz. of silver."

DESIDERATA FOR THE MUSEUM OF ECONOMIC GEOLOGY OF INDIA.

I.

MINES AND MINING PRODUCTS.

1. Specimens of all crude ores, just as found. If possible also, of the rocks or matrix in which found; of those indicating the vein at the surface; of the walls of the veins; of the strata or beds passed through before reaching them; and of the rocks of the surrounding country.

2. The ores after preparation for the furnace by picking, washing, stamping, roasting, &c.

3. The rejected ores, gravel or stones found with those used; which often go under odd names, as those of "mother, devil," or the like.

4. The fluxes used, if any.

5. Memorandum of the kind of fuel used, samples of it if coal or coke, &c.; names of the trees, as bamboo, &c. if charcoal; and if not too far, send specimens.

6. The roasted or half smelted ore.

7. The pure metals, as obtained in a merchantable state, of all the qualities.

8. The slags, of all kinds, from the furnaces and smeltings.

9. Drawings or models (to scale of possible) of all furnaces, machinery, and implements used in any of the processes, with drawings, plans, and models of the mine. Earthen models of the furnaces, &c. may often be well made, by the native image makers for a mere trifle.

10. Specimens of any tools used.

11. Traditions, history, and statistics of the mine or mineral products, as (1.) How and when found; (2.) Produce, gross and net; (3.) Rent if farmed, or what tax payable on the product; (4.) Price of daily labour; (5.) Amount of labour obtainable for a given price; (6.) Estimated profits, past and present; (7.) Reasons for decay or increase; (8.) What is now required to make the mine more productive; (9.) Copies or notices of any books or accounts of the mine; (10.) Health, comfort, morals, and condition of the workmen employed, average of ages, and of life among them if thought unhealthy; seasons and hours of work. Superstitious notions, peculiar diseases, &c. &c.

II.

BUILDINGS, CEMENTS, POTTERY, COLOURS, ROADS, &c.

1. Specimens from the quarries, of all kinds of building stones, useful or merely ornamental.

2. The same of limestones, shells, corals or other articles, used to make lime or cements of all kinds.

3. Specimens of the strata above and below the quarried stone.

4. Any fossil shells, bones, fish, plants, insects, or other appearances of organic remains large or small, found in or near the quarries, or amongst the rubbish and water-courses of quarried spots. If specimens appear too large to move, please to give a notice, with an eye-sketch, and estimate of the expence of moving, and preserve it till a reply is sent.

5. Specimens of the building stones or remarkable bricks used in any public edifices, monuments or tombs, with the date of their erection if known, and a note to say if exposed to weather or protected by stucco, paint, or roofs.

6. Memoranda and specimens of any plants or animals destructive to masonry, as boring worms and shells in water, and the like, with specimens of their work.

7. Ornamental or stucco-work : specimens of it, new or old, interior or exterior, with the best account procurable of the materials, preparations, and working of them.

8. Specimens of stones and marbles, shells, &c. used for image or ornament-making ; of earths for pottery, and varnishes of coloured earths of all sorts, whether used as pigments or not.

9. Specimens of peculiarly good materials used for roads, whether ancient or modern, with prices, methods of using them, and other Memoranda.

10. Prices of all the above ; rates of labour, carriage, &c. from the rough to the wrought state, and all other statistical details as in the case of Mines and Mineral products above mentioned.

III.

AGRICULTURAL GEOLOGY.

1. Specimens of soils of good, and the best qualities, for all kinds of produce, as sugar, cotton, tobacco, &c.

2. Of infertile soils or veins of earth.

3. Of the subsoil or rock.

4. Of the stones scattered about these soils.

5. Memoranda relative to the height of these soils above the water of wells in the rains and dry season, and of its drainage, shelter, exposition, &c.

6. Of any kind of earths, mud, or stones used as manures, as peats from the jheels, kunkurs, &c.

7. Of the deposits (fertile and infertile) left either by the common inundations or by violent floods, with memoranda of their effects on the cultivated soil.

8. Specimens from any separate spots, where gravel or stones are collected in quantities after inundations or floods.

9. Accounts of remarkable floods, and average heights of the rise of rivers, of the raising of the soil, alterations in its produce consequent thereupon, and all other details.

10. Memoranda relative to the formation or destruction of river-banks, islands, &c. with measurement if obtainable.

11. Samples of all kinds of efflorescent salt-earths, with specimens of the different salts prepared from them, prices of preparation, selling rates, and accounts of the processes and uses of the salts.

12. Specimens of brine springs, with details of manufacture if boiled for salt, and statistics of labour and produce, &c. as in the case of mines.

IV.

MEDICAL GEOLOGY.

1. Specimens of mineral medicines of all sorts, whether produced on the spot or imported, crude and prepared, with notes and samples of the process of preparation in all its stages.

2. Of the water of mineral springs, their temperature, incrustations about them, account of their uses, and specimens of the rocks or soil in which found.

V.

NATIVE METALLURGICAL PROCESSES, OR MINERAL MANUFACTURES.

1. Exact descriptions of them, however rude or simple they may appear, with samples of the ores, fuel, fluxes, products, slags, &c.
2. Models or drawings (to scale if possible) of the furnaces and implements of all kinds ; specimens of these last may be sent.
3. Memoranda and samples of the earths or sands used for moulds in castings, of the crucibles and beds, raw and baked, and of the raw material from which made.
4. Prices of raw and wrought materials.
5. Drawings of machinery used for turning, boring, polishing, &c.

In conclusion : It is not supposed that any individual, unless wholly devoted to the research, can supply the whole of the desired specimens, or even of the knowledge relative to any one product; but any *single* item of the foregoing may be of importance, at sometime, to some one ; and it will be the special duty of the Asiatic Society, and of the Curator of the Museum, to see justice done to every contribution ; whether relating to the Geology of India in general, or to this peculiar branch of it.

H. PIDDINGTON,

Curator, Museum Economic Geology.

Correspondence respecting the Society's Museum of Economic Geology.

NOTE.—The institution of our Museum of Economic Geology is necessarily of such interest, that the publication of the Correspondence having reference to it, and to the appointment of a joint Curator, will be read with satisfaction by many of my readers.



To H. TORRENS, ESQ. Secretary to the Asiatic Society.

SIR,—In continuation of my letter, No. 433, dated the 24th March last, on the subject of the formation of a Museum of Economic Geology in India, I am directed by the Right Honorable the Governor to transmit, for the information of the Asiatic Society, Extract Paragraphs 2d and 3d of a despatch from the Honorable the Court of Directors, No. 13 of 1841, dated the 8th September, and to invite the Society's particular notice to the requisition therein contained, with a view to its being complied with whenever practicable.

2.—I have been further desired, in connection with the 2nd paragraph of my letter dated the 14th April last, to enclose for the Society's information, copy of a circular addressed by the Military Board to the

Superintending Engineers, forwarding a copy of Captain Tremenhoe's Memoir, agreeably to Mr. Piddington's suggestion.

I have, &c. &c.

G. A. BUSHBY,

Secretary to the Government of Bengal.

FORT WILLIAM, the 1st December, 1841.

Extract from letter No. 13 of 1841, from the Honorable the Court of Directors, in the Revenue Department, under date the 8th September.

2.—We have transmitted a copy of Mr. Piddington's Report to Mr. Delabeche, the Director of the Museum of Economic Geology in this country, and we have informed that gentleman, that we shall be happy to receive from him for transmission to you, any communication which he may desire to make on the subject of that Report, as well as any further specimens which it may be in his power to add to the collection.

3.—We desire that you will transmit to us any specimens which you may be enabled to collect of objects, which in your opinion may be appropriately presented to the Institution over which Mr. Delabeche presides.

(A true Extract,)

G. A. BUSHBY,

Secretary to the Government of Bengal.

CIRCULAR NO. 31.

To the Superintending Engineers.

I am instructed by the Military Board to send for circulation to the Officers of Public Works under your control, the copy of Mr. Secretary Bushby's letter No. 432 of 24th March last, and copies of a Memorandum drawn up by Captain Tremenhoe, regarding the establishment in Calcutta of a Museum of Economic Geology, and to request that you will invite the co-operation of the Executive Officers of your circle in the attainment of the proposed end.

2.—The Memoir contains full instructions as to the manner in which the co-operation of officers may be best effected. It shews what speci-

mens should be collected, and what information should accompany them.

3.—The Board desire me to express their hope, that officers will turn their attention to the objects contemplated in the formation of the proposed Museum, and they desire me to request, that when any box of specimens is collected the circumstance may be reported to you, and your orders taken as to its transmission before any actual expense is incurred. A copy of the descriptive papers which are to accompany the box should also be sent to you, in order, that if the information appears deficient in any essential point, you may have the deficiency supplied before the specimens are actually sent to Calcutta.

4.—The Board would wish you to exercise your discretion as to having the boxes sent in the first instance to your own office and thence transmitted to Calcutta, or in desiring Executive Officers to send the specimens direct to the Presidency ; but in either case, they should be sent to the Board's office for transmission to Government.

5.—The Board request particular attention to the 2d paragraph of Mr. Bushby's letter, but they do not conceive it to be the intention of Government, that useful specimens should be entirely withheld, when opportunities of sending them free of expense do not occur. The Board trust, however, that the most economical mode of transmission will always be adopted.

I have, &c.,

(Signed) A. BROOME,

Officiating Secretary Military Board.

Military Board Office, 6th November, 1841.

To G. A. BUSHBY, Esq., Secretary to Government, General Department.

SIR,—Your letter dated the 1st ultimo, with its enclosures, was laid before the Meeting of the Asiatic Society held in this month, and the Meeting referred the subject to the Committee of Papers, in order that full consideration might be given to the important subject urged by the Honorable Court of Directors upon the attention of the Society, in connexion with the formation of a Museum of Economic Geology for India, and the collection and arrangement of specimens here, of which duplicates should be transmitted for preservation in appropriate Museums in England.

2.—The Governor of Bengal is aware, that a suitable room of our premises has been assigned for the specimens brought to India by Captain Tremenheere, and that the Society has a large assortment of Mineralogical and other specimens, collected from various parts of India, from which, with care in the arrangement, and particular attention to the localities from which the articles have been procured, a valuable Museum of the kind desired, might now be commenced upon, so as to form nucleus of an Economic institution, to which all public officers might refer for information, and into which all further objects of useful discovery might, as collected by the Officers of Government, be brought for safe deposit and investigation.

3.—But for the arrangement of the specimens we possess in the scientific order requisite, and for their discrimination and proper ascertainment, the entire services of a gentleman versed in somewhat more than the rudiments of sciences of Geology and Mineralogy, and a proficient in Chemistry, and the use of tests for purposes of analysis, will obviously be indispensable; and it would be a great advantage that this gentleman should also not be a stranger to the Geography and languages of the country, and that he should be known to, and in habits of correspondence with, persons engaged in similar pursuits in different parts of India.

4.—The Curator the Society has recently obtained from Europe, Mr. Blyth, is eminent in all departments of Zoology, and his indefatigable exertions in this line, have already increased largely the value of the Museum, as well by the addition of an infinity of new specimens excellently set up, as by the discovery amongst our neglected stores of objects valuable to science which had escaped the less accurate investigation of his predecessors in this line. But Mr. Blyth's whole time is occupied in this very extensive branch of the Museum, and he does not profess at present, to be sufficiently acquainted with Mineralogy and Geology, to be able to superintend the formation of the desired Economic Museum; besides that being new to the country, and unacquainted with its localities and languages, he would feel greatly at a loss in the attempt to arrange and investigate the affinities of soil, and other characteristic peculiarities of provinces and districts, which it should be the aim of an Economic Museum to display.

5.—The Society has been indebted to Mr. Piddington for all that has yet been done in this department; the qualifications of this gentle-

man as a chemist and man of general science, are well known to the Governor of Bengal, but his attainments in the branches of Geology and Mineralogy, and the attention he has given to these sciences in their special application to India, may not have been antecedently represented to his Lordship. He is regarded by the members of the Committee, and by the Society for which they are acting, as eminently qualified to undertake the particular duties and charge to which their attention has been thus directed.

6.—Circumstances at the present juncture enable this gentleman to give to the Society a large portion of his valuable time, but render it impossible, that they should be accepted without remuneration. On the part of the President and Committee of Papers of the Society therefore, I am directed to request you will submit to his Lordship, that if importance be attached to prosecuting researches in Economic Geology, and to the careful examination and arrangement of specimens and objects connected with this science, they see no means of satisfying the wishes of the Government and of the Court of Directors, except by securing the services of Mr. Piddington, on a separate salary equal to that now assigned to the Curator; viz. 250 Rupees per mensem. We cannot hope that Mr. Piddington will engage permanently, or for any given period on these terms, but we doubt not that his exertions for the time of his devoting himself to this branch of our Museum, will place the department on such a footing, as will much facilitate its being afterwards carried on by less competent persons; and in this manner, a basis will be laid for a Museum of infinite value to science and to the public service.

7.—Mr. Piddington's services, if engaged, will be of infinite use to the Society in other branches also, for he is versed in Numismatology, and proficient in all the knowledge required for the discrimination and arrangement of scientific objects. The Committee would propose for him the title, "Joint Curator," giving to his special charge, as well the Geological as any other parts of the Museum, that we might consider him specially qualified to arrange and report upon.

I have &c. for the Committee,

(Signed) H. TORRENS,

Secretary to the Asiatic Society.

Asiatic Society's Rooms, Calcutta, the 27th Jan. 1842.

No. 265.

To H. TORRENS, Esq. Secretary to the Asiatic Society.

General Dept.

SIR,—I am directed to acknowledge the receipt of your letter, dated the 27th ultimo, conveying the recommendation of the President and Committee of Papers of the Asiatic Society for the appointment of Mr. Piddington as Joint Curator to the Museum of Economic Geology, with reference to the orders for the formation of a Museum of Economic Geology for India.

2.—In reply I am desired to state, that the Right Honorable the Governor of Bengal, with the concurrence of the Government of India, has been pleased to sanction a payment from the Treasury of 250 Rupees a month for the remuneration of Mr. H. Piddington in the appointment of "Joint Curator" to the Museum of Economic Geology, which the President and Committee propose to confer on that gentleman. The accompanying Extract, Paragraph 5, from a letter dated the 23d June 1841, in the Revenue Department, from the Honorable the Court of Directors, will inform the Society as to the views of the Honorable the Court of Directors respecting the appointment which has been thus constituted, and the duties that he is expected to perform in connection with the Museum of Economic Geology.

3.—I am directed to take this opportunity of transmitting for the information of the Asiatic Society, a copy of a despatch from the Court of Directors, No. 14 of 1841, dated the 2d of November, and of the Letter and Memorandum from Mr. Delabèche therein mentioned.

I am, &c. &c.

G. A. BUSHBY,

Secretary to the Government of Bengal.

FORT WILLIAM, the 26th February, 1842.

Extract from letter, No. 10 of 1841, from the Honorable the Court of Directors, in the Revenue Department, dated the 23d June.

5.—We cannot doubt that much benefit may be derived from such an institution under proper superintendence. In order, however, to make it practically useful, we apprehend that it will be necessary to place it

under the charge of an individual sufficiently versed in Chemistry to be competent to make the necessary analysis of ores, soils, &c. and to suggest the means of turning those analyses to account. To this individual might also be assigned the care of the Mineralogical records deposited in the Museum, which will probably in no long time become so voluminous as to be altogether useless, unless properly classified and arranged. In our despatch of the 27th May, (No. 5,) 1840, we anticipated the necessity of the appointment of such an officer, and we shall not object to your assigning a moderate salary to any individual who may be found competent for the discharge of the duties of such a situation.

No. 14 OF 1841.

Our Governor of the Presidency of Fort William in Bengal.

In continuation of our dispatch in this Department, (Museum of Economic Geology,) dated the 8th September last, (No. 13,) we transmit for your information copy of a letter (dated 9th Sept. 1841,) which we have received from Mr. Delabeche, and of the Memorandum which accompanied it, on the subject of the establishment of a Museum of Economic Geology in India.

We are,

Your loving Friends,

(Signed) GEORGE LYALL,

„ J. L. LUSHINGTON,

„ H. LINDSAY,

„ JOHN LOCH,

„ H. SHANK,

„ J. PETTY MUSPRATT,

„ C. MILLS,

„ J. W. HOGG,

„ F. WARDEN,

„ JOHN COTTON,

„ ARCHDEACON ROBERTSON,

„ HENRY ALEXANDER,

„ HENRY WILLOCK.

London, the 2d Nov. 1841.

*Ordnance Geological Survey, Haverfordwest,
South Wales, 9th Sept., 1841.*

JAMES MELVILL, Esq. &c. &c. &c.

SIR,—I have the honor to acknowledge the receipt of your communication of the 2d instant, accompanied by the report to which it refers of Mr. Piddington, on a collection of specimens taken to India by Captain Tremenheere, as a basis for a collection for a Museum of Economic Geology in India.

As the Court of Directors of the East India Company were pleased to say that they would be happy to receive any communication on the subject which I might make, I have ventured to send the accompanying memorandum, and have therein given a brief account of the Museum of Economic Geology, established under Her Majesty's Government, for the information of the Directors.

Permit me through you to return the Directors my sincere thanks for their kind offer of sending specimens from India to our Museum. Every thing which relates to the Metallurgical processes of India would be highly valuable: specimens of steel, such as is used for arms, would be particularly so. Ores of the useful metals, and any information relating to their mode of occurrence would be very acceptable. Models, or drawings from which models could be constructed, of any of the native mining machinery, methods of reducing the metals, or tools used in mining, would be valuable, however simple these contrivances may be.

Perhaps you will do me the favour to assure the Directors, that if they may consider any service I can render in the formation of the proposed Museum at all desirable at any time, I shall esteem myself fortunate in being able to afford it.

(Signed) H. F. DELABECHE,
Director, Ordnance Geological Survey.

*Memorandum respecting a Proposed Museum of Economic Geology in
India.*

Not being aware of how far the Directors of the East India Company may be desirous of forming in India a Museum of Economic Geology, similar to that established under Her Majesty's Government in this country, modifying it only to suit the difference of conditions existing in the respective countries, or may be informed of the exact character

and design of the Museum of Economic Geology in London, perhaps it may be useful, and not altogether out of place, briefly to state the objects for which the latter were founded, and to shew the manner in which we endeavour to attain them, before I venture to offer any observations which Mr. Piddington's Report may have suggested on the proposed establishment in India.

The Museum of Economic Geology was founded, in order to obtain a more perfect and general knowledge of the mineral wealth of the United Kingdom and its colonies than now exists,* and to render the knowledge thus obtained readily available to the public, endeavouring to promote an increase in the advantages to be derived from our mineral wealth, by shewing where and in what manner mineral substances at present untouched in particular districts may be profitably worked; by pointing out that by adopting the mode of working elsewhere either in this or other countries, mineral substances may be more profitably raised than they now are in certain districts, and by preventing an useless expenditure of time and capital in researches which can only end in disappointment.

Another chief object is to shew the application of Geology to Agriculture, and to afford to the public the facility of obtaining correct analysis of soils at a rate so moderate, as to bring them within the means of the many, and thus, by obtaining a multitude of facts relating to soils, be enabled to arrive at conclusions which may be of very material benefit to the agriculture of the country, and which might not otherwise have been rendered so readily apparent.

In fact, the Museum may be considered, without further detail, as an establishment founded to shew and promote the application of Geology to the useful purposes of life in a variety of important ways, and thus aid in advancing the general welfare of the country.

Though the establishment is termed a Museum, from containing collections of mineral and metallurgical specimens, models, &c., these collections only constitute a part of the general whole, and are solely intended to render that whole effective. Under the same roof, there is a well appointed Laboratory, an office for the accumulation and preservation of the mining documents of the United Kingdom, and a work-shop

* Itself an object of great national importance, as even at present it is known that the annual value of the Coals (taken at the pit mouth, and of the metals, and of a few other mineral products) in their first merchantable conditions raised in the United Kingdom, exceeds £20,000,000.

for the construction of models from working drawings, both British and foreign. Mr. Richard Phillips, F. R. S., long distinguished as an analytical chemist of the first order, has charge of the Laboratory and of the mineral and metallurgical collections, and Mr. Jordan, a gentleman of considerable ability, and previously Secretary of the Polytechnic Society of Cornwall, superintends the Mining Record Office and the Model Department. Both gentlemen receive pupils under certain regulations, the former in analytical chemistry, metallurgy and mineralogy; the latter for mining, section and plan drawing, and mining machinery; it being considered a great object to teach as much as possible by aid of the establishment, its collections of mineral and metallurgical specimens, models, &c. being freely employed for the purpose, and not intended for mere shew, though eventually the public will be admitted to view them gratuitously in the same manner as the collections of the British Museum are exhibited.

The establishment may be considered as formed to a certain extent of distinct parts, though they are necessarily much blended with each other, and may be said to consist of the Mineral and Metallurgical Collection, the Laboratory, the Model Department, and the Mining Record Office.

The Mineral and Metallurgical Collections are divided into,

a.—The various ores of the useful metals at present raised in the United Kingdom and its Colonies.

b.—Specimens to illustrate the mode in which these ores occur, and the general conditions under which they are found.

c.—A metallurgical series, shewing the mode of reducing the ores to the metallic state, as practised in the United Kingdom or Colonies.

d.—The foreign ores of the useful metals, in order to accustom the eye of the British miner to all known appearances of the ores of the useful metals.

e.—Specimens illustrative of the mode of occurrence of these foreign ores, so that the British miner may see wherein this may differ from, or agree with, the manner in which ores are found in the United Kingdom.

f.—A series illustrating the manner in which the ores are reduced to the metallic state in foreign countries.*

* The British specimens of ores and metallurgical processes are kept distinct from the foreign, to shew at one glance what is really known or done in the United Kingdom, and therefore what more or less is known, as relates to the same subjects in other countries.

g.—A series illustrating the manufacture of steel, brass, and other metallic compounds or alloys.

h.—An extensive series, illustrating the rocks which either have been or may be advantageously employed for Architectural or Engineering purposes.

i.—The various cements, bricks, tiles, or other artificial mineral compounds which may be, or have been, employed for the same purposes.

k.—A series of the substances used in the manufacture, and illustrating the manufacture itself of British porcelain, earthen-ware, and the coarser potteries.

l.—A series of soils, with their analysis attached, and a notice of such circumstances connected with the climate and the situation of the localities where they occur as can be obtained, accompanied by such specimens of the subsoils or rocks in which they rest as can be procured.

In the *Laboratory*, analyses of mineral substances, such as ores, rocks, soils, &c. are made at a regulated price for the public, who not only thus obtain correct information without fear of fraud from interested motives, but also do so at moderate cost. Analyses are also executed for such Government Departments as may desire them; and pupils, as above mentioned, are received.

The *Model Department* will consist (and numerous important models are already in the collection) of models to illustrate mining operations, from the most simple conditions up to the most complicated of mining machinery, and of such operations connected with mines as can be well shewn by models, not only British but foreign, and of furnaces and other works for the reduction of the metals. The tools and instruments used in mining in different countries, with specimens of the ropes, chains, &c. employed, form also part of this collection.

In the Mining Record Office, not only will the plans and sections which relate to British mining be accumulated, but all documents relating to foreign mines which can be obtained, will be added to the collection, and it is expected, from the arrangements which have been made, that much important information will thus be brought together. Geological maps and sections of various countries will be here assembled, and it is intended eventually to form a *Library*, containing works in

various languages, which may relate to the application of Geology to the useful purposes of life.

It might, at first sight be supposed, however desirable such an establishment as this, which has been thus briefly noticed, may be in India or elsewhere, that it would require considerable expenditure and much trouble to form. From experience I can say, that I believe the contrary would be the case, provided it were placed directly under a Government, which necessarily in almost all countries, possesses the means of carrying out the objects of an institution of this kind in a manner which cannot be within the reach of any body of men formed into a society, however active the members of that body may be.

The collections in the Museum of Economic Geology though no doubt valuable, have cost the country a mere trifle, having been chiefly presented by persons anxious to promote the success of the institution, because it was national, and belonged to the public, under the controul and care of Government. At the same time it must be admitted, that a large portion of the collections have been formed through the exertions of the Ordnance Geological Survey, during its progress through the country, causing the Museum to be more known and appreciated than it might otherwise so soon have been, and thus inducing many influential persons to make extensive presents to it.

It would appear from experience, that in such establishments outlays of money are at first less requisite than arrangements by which the various means of information at the disposal of a Government can be rendered available, and at a suitable place set apart for the reception of the different specimens, models, and other objects of interest that can be collected, waiting, as was done at the Museum of Economic Geology in London, until the accumulation of information and of specimens, models, or other objects of interest should be sufficiently great to carry out the design of the establishment on a more extended scale; it being at the same time observed, that a laboratory and a good analytic chemist appointed to it, may be considered as among the earliest requisites.

The collections taken out to India by Captain Tremenheere, were necessarily incomplete, and were merely intended as a foundation for a more extended series of specimens, illustrative of the applications of Geology to the useful purposes of life; but like all such first collections, they are most valuable as constituting such a foundation, and in this in-

stance, they have been the means of calling forth a very able report from Mr. Piddington, as to his views respecting the requisites for collections of this kind in India. Though Mr. Piddington's catalogue of *desiderata* may appear large, and refer perhaps, more to a complete series of collections, than to what may be sufficient and essentially required for the well-working of a Museum of Economic Geology in India, yet a large part of them could be supplied at a very moderate cost. Time and opportunity will be required far more than money for a very large part of the desired collections, though no doubt, some small outlays may from time to time be necessary. It would be our earnest desire, as well as our duty, at the Museum of Economic Geology, to aid an institution of the like kind established under the East India Company in India, and it would be very easy to endeavour, as much as possible, to obtain duplicates of Foreign as well as British specimens, likely to be useful in India, when we collect them for ourselves. Copies of the plans and sections of the Metalliferous and Coal mines in our Mining Record Office could readily be furnished at the expense of the copying, and care could be taken to select only such as would be likely to be useful in India. Arrangements might be made to find competent persons to construct copies of such of our models as might be thought valuable, particularly those required in the earliest conditions of a mine. In fact, much could be accomplished, at once and readily, in this manner, should it meet the approbation of the Directors of the East India Company; and as regards the applications of Geology under consideration, we might be rendered available for what is done in the United Kingdom and in many parts of Europe; at the same time it would be desirable that applications to the friends of India, resident in this part of the world, should not be neglected.

The most important part of the collections must necessarily be made in India, and can probably be best accomplished in the manner pointed out by Capt. Tremenheere and Mr. Piddington.

I would venture to suggest, that it would be very desirable by any methods that may be deemed most expedient, as early as possible to procure an estimate, however rough it may be, of the mineral resources of India, *i. e.* that those points which may appear the most promising, may receive the required attention, and the real state of knowledge on this subject be shewn by something like effective and trust-worthy docu-

ments. By the same means, the collections might gradually become considerable, comparisons be instituted where comparisons were likely to be useful, both as regards the parts of India with each other, and with foreign countries. Analysis of soils, which should be made as well with regard to their physical as chemical conditions, due attention being paid to climate, would accumulate, and eventually a mass of information would be collected, which could not fail very materially to assist in improving the agriculture, and developing the mineral wealth of the vast territory under the Government of the East India Company.

(Signed) H. F. DELABECHE,

Director of the Museum of Economic Geology.

9th September, 1841.

TO H. TORRENS, ESQ., *Secretary Asiatic Society.*

SIR,—With reference to our conversation on the subject of a Laboratory for the Museum of Economic Geology, I set down here as requested, such Memoranda as occur to me for the information of the Committee of Papers and the Society.

1.—“A laboratory and a good analytical chemist appointed to it may be considered as amongst the earliest requisites for a Museum of Economic Geology,” says Mr. Delabèche, in replying to the Court of Directors on their referring to him my report of February 1841, and he is writing in England. We may add here, I think, “in India far more than in England?”

2.—The arrangements for a laboratory require a room, and I cannot see how to obtain one of improper size, without adding to our present accommodation.

3.—The arrangement proposed by you, would give us additional room for many things which now become much crowded: and for models, records, &c. which will gradually accumulate in the Museum of Economic Geology, in which, be it remembered, we have to collect *both* Indian and European knowledge and specimens.

4.—We require room for coarse furnace work, and for our more delicate analytical operations, which cannot (be it remembered) be carried on in open rooms, or left to chance-meddling, or exposed to theft if of value. Room for the Superintendent, where he can work undisturbed

by visitors, is also highly desirable under existing arrangements, and at the very best time for work, a morning is often lost by the indispensable civilities to chance visitors. Where laboratory work is going on, this is out of the question.

5.—It may appear, that I am asking for means and appliances more extensive than our present Museum of Economic Geology requires; but to this it may be replied, that there is no lack of laboratory work even now, and when we make known our views and desires, there will be plenty more: add to which, that the first reference to us from Government *may* be our requiring all the resources of a good laboratory to reply to it creditably. I may be excused, if I remark in conclusion, that it belongs to the Society, with such an opening as is now afforded to it, to shew its readiness to do honour to the patronage it meets here and at home.

H. PIDDINGTON.

16th March, 1842.

NOTE.—The means and appliances to which Mr. Piddington alludes, as necessary for the efficient establishment of the Museum, have been afforded by the Society in the same spirit of liberality and zeal for the cause of science, which actuated the Honorable the Court of Directors and the Government of India, in contributing so eminently to the formation of the institution. The Honorable the President of the Asiatic Society, (H. T. Prinsep, Esq.) at once proposed to make such additions to the spacious building which contains our Library and Museum, as might not only supply a proper Laboratory, but also give additional room for the Geological and Mineralogical department, as well as allow of the appropriation of a new and handsome apartment to be added to the upper story of the house to a better disposition of our Books, or to our Ornithological Collection, which daily undergoes augmentation. These works are in a forward state, the President's proposition having been warmly adopted.



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DRAWN UP BY H. PIDDINGTON, CURATOR MUSEUM ECONOMIC GEOLOGY, ASIATIC SOCIETY'S MUSEUM.

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Day.	Morning Tide A. M.					Evening Tide, P. M.					Weather, &c.		
	Low Water.		High Water.		Wind.	Low Water.		High Water.		Wind.			
	Time.	Height.	Time.	Height.		Range of Tide.							
1 Friday,	9 16	5 6	3 18	9 4	3 10	N.	9 47	5 3	3 39	10 3	5 0	N.	7 15 A. M. light rain, noon overcast, 4. 35, P. M. a light shower.
2 "	9 58	5 9	3 56	9 1	3 4	N.	10 47	6 1	4 6	9 2	3 1	N.	— day alternately clear and cloudy.
3 Sunday,	11 19	4 11	5 18	8 9	3 10	N.	11 53	5 10	5 28	8 6	2 8	E.	— clear all day.
4 "	0 0	0 0	6 17	9 4	0 0	N.	0 54	4 8	7 26	9 11	5 3	N. E. ..	— ditto ditto.
5 "	1 22	5 7	7 38	10 7	5 0	N.	1 43	3 9	8 19	10 1	6 4	N. E. ..	— ditto ditto.
6 "	1 57	4 9	8 57	11 2	6 5	N. W.	2 27	2 9	8 54	10 6	7 9	N.	6 7 A. M. squall from N. W. with rain, noon cloudy, 5 50 P. M. rain.
7 ○	2 58	4 7	9 4	11 6	6 11	N. W.	3 15	2 7	9 50	11 4	8 9	N.	Clear all day.
8 "	3 52	4 5	10 18	12 1	7 8	N.	4 17	2 1	10 58	11 3	9 2	N.	6 A. M. clear, 11 45 A. M. cloudy with light showers occasionally, 11 15 P. M. rain.
9 "	4 7	3 9	11 15	12 8	8 11	N. W.	5 12	2 3	11 27	11 5	9 2	N.	4 50 A. M. rain, noon cloudy, 5 18 P. M. rain
10 Sunday,	6 2	3 9	0 0	0 0	0 0	N.	6 27	3 7	0 17	12 11	9 4	N.	— day cloudy, 4 25 P. M. light rain.
11 "	6 43	4 5	12 43	11 7	7 2	N. E. ..	7 12	4 7	12 52	12 3	7 8	S. E. ..	— day alternately clear and cloudy.
12 "	7 13	4 9	1 19	11 3	6 6	N.	7 48	4 9	1 7	11 8	6 11	W.	3 43 P. M. showers.
13 "	8 6	5 3	2 9	10 11	5 8	N.	8 12	4 10	2 13	10 11	6 1	N. W.	— day cloudy, 11 47 A. M. rain, 52 P. M. squall from westward with heavy showers.
14 (	8 18	5 7	2 19	10 4	4 9	N.	8 53	5 6	2 27	8 6	3 0	S. E. ..	— ditto ditto.
15 "	9 3	6 1	3 9	8 7	2 6	N.	9 29	5 7	3 12	8 9	3 2	Westy,	— day alternately clear and cloudy, 5 4 P. M. very light drizzling rain.
16 "	9 47	6 3	3 42	8 10	2 7	N.	10 49	5 7	4 11	8 7	3 0	N. E. ..	Forenoon clear, 1 15 P. M. showers 1 37 thunder.

Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—January 1841.—(Continued.)

Day.	Morning Tide A. M.					Evening Tide P. M.					Weather, &c.			
	Low Water.			High Water.		Wind.	Low Water.			High Water.		Range of Tide.		
	Time.	Height.	Time.	Height.	Time.		Height.							
								Range of Tide.						
17 Sunday,	10 57	5 2	5 28	9 3	4 1	N.	11 49		5 4	5 38	9 1	3 9	N. E. ...	Clear all day.
18 "		0 0	0 0	6 25	9 4	0 0	N. E. ...	0 57	3 9	7 42	9 3	5 6	N. E. ...	Forenoon rather cloudy, 11 30 A. M. rain in large drops, afternoon clear.
19 "		1 18	5 1	7 32	9 5	4 4	N.	1 49	3 8	8 13	9 4	5 8	N. E. ...	ditto ditto 10 55 A. M. light rain, 1 P. M. thunder, ditto ditto.
20 "		2 12	5 3	8 27	9 7	4 4	N.	2 47	3 7	9 15	9 6	5 9	E. ...	day alternately clear and cloudy.
21 "		3 16	5 2	9 23	10 6	5 4	N. E. ...	3 43	3 1	9 52	10 3	7 2	N.	ditto ditto, 2 47 P. M. drizzling rain.
22 ●		4 2	4 11	10 5	11 3	6 4	N. E. ...	4 54	2 11	11 7	10 7	7 8	N.	ditto ditto, 11 20 A. M. heavy showers with thunder.
23 "		5 14	4 9	11 9	11 6	6 9	Easterly.	5 49	2 8	11 56	10 9	8 1	N.	ditto ditto.
24 Sunday,		6 4	5 7	0 0	0 0	0 0	N. E. ...	6 15	2 3	0 8	11 9	9 6	N. E. ...	ditto ditto.
25 "		6 42	5 10	0 32	10 11	5 1	N.	6 53	2 1	0 57	11 6	9 5	N.	ditto ditto, 48' P. M. passing showers, 1 20 P. M. squall with rain.
26 "		7 9	6 2	1 4	10 10	4 8	N.	7 12	2 4	1 9	11 8	9 4	Sty. Ny.	6 55 A. M. drizzling rain. Day overcast.
27 "		7 17	6 4	1 17	10 11	4 7	N.	7 42	2 9	1 20	11 9	9 0	Sty. Ny.	day alternately clear and cloudy.
28 "		7 54	6 3	1 56	10 9	4 6	N. W. ...	8 4	3 2	2 0	11 2	8 0	N. W. ...	5 32 A. M. drizzling rain. Day alternately clear and cloudy, 2 58 P. M. rain.
29 "		8 9	5 8	2 12	10 3	4 7	N.	8 11	3 8	2 18	10 6	6 10	N. E. ...	7 57 A. M. drizzling rain. Day alternately clear and cloudy.
30 D		8 2	5 5	2 29	9 10	4 5	N.	8 45	5 7	2 5	9 11	4 4	N.	day alternately clear and cloudy, 1 58 P. M. squall with rain.
31 Sunday,		8 56	5 3	3 2	9 8	4 5	N.	0 0	0 0	3 13	9 6	0 0	N.	day alternately clear and cloudy. [Signed,] Wm. SCOTT, Assist. Master Attendant.

Wm. SCOTT,
[Signed,] Assist. Master Attendant.

1841.	Morning Tide, A. M.						Evening Tide, P. M.						Wind.	Rain in Inches.	Weather.				Remarks.
	Low Water.		High Water.		Range of Tide.	Wind.	Low Water.		High Water.		Range of Tide.	Morning A. M.			Evening P. M.				
	Time.	Height.	Time.	Height.			Time.	Height.	Time.	Height.		2 16			8 16	2 16	8 16		
Feb'y.	h. "	ft.	h. "	ft.	"	N. W.	h. "	ft.	h. "	ft.	"	V. & N. W.		Overcast,	∞	∞	Nimbus,	The new Tide Gauge is situated close to the old one, but further from the mouth of the river. Occasionally two high Tides occur within the twelve hours. For instance on the 7th where the high Tide is put down as occurring in the afternoon at 12h 11' where as it took place at 00h 17' on the 8th. The direction of the wind is put down for the times of Tide. The signs in the column for the weather are those adopted by Mr. Howard in his Meteorological Essays. The establishment will be made out after three months' observations, the set of the currents and the time of slack water has not been determined. The Zero point is ascertained by two marks in the walls of the Tide Gauge, with reference to a fixed point. (Sd.) E. M. ELLIOT, 2d B. Engrs. Supt. Magt. Singapore.	
6	0					N. W.	4 55.5	0 10.8	11 28	9 1	8 05.2	V. & N. W.	2 25	Overcast,	∞	∞	Nimbus,		
7	1	41	4 00	10 33	6 02.2	N. W.	5 24	0 08	12 17	9 4	8 08	N by E. & N.	0 26	..	..	....	....
8	5	26.5	3 03.9	11 20	7 00.1	N. N. W. & V.	6 03.5	0 10.9	..	..	..	W. by S	0	Overcast,	∞	∞	∞		Occasionally two high Tides occur within the twelve hours. For instance on the 7th where the high Tide is put down as occurring in the afternoon at 12h 11' where as it took place at 00h 17' on the 8th. The direction of the wind is put down for the times of Tide.
9	5	51	3 00	0 39	2 03.6	N. by W.	6 40	2 01.7	00 05	10 6 2	8 04.5	N. & W. & V.	0	Overcast,	∞	∞	Overcast,		
10	6	27	3 05.6	0 53.5	9 11	6 06	Variable	6 48	3 06.2	00 54	10 4	6 09.8	N. & V.	0	Overcast,	Overcast, ∞	Overcast,		
11	7	1.5	3 05.1	1 23	9 10.8	6 05.7	North,	7 23	3 06	1 45	9 2.6	5 08.6	N & V	0	∞ clear ∞	∞	∞		Overcast,
12	8	14	2 07	1 37	9 01	6 09	V. & N.	7 47	4 00	2 28	8 04	4 04	N. & V.	0	Serene,	∞	∞		Serene,
13	8	46	3 01	2 09	9 02.1	6 01.1	V. & N.	8 24	5 02.9	3 17	7 05.9	2 06	N. & V.	0	Serene,	∞	∞		Serene,
14	9	58	3 06.6	2 31	8 09.9	5 03.3	V. & N.	9 08	6 00.3	5 17	6 09.8	0 09.5	N. & V.	0	..	..	....		The signs in the column for the weather are those adopted by Mr. Howard in his Meteorological Essays. The establishment will be made out after three months' observations, the set of the currents and the time of slack water has not been determined. The Zero point is ascertained by two marks in the walls of the Tide Gauge, with reference to a fixed point.
15	11	42	3 06	3 11	8 02.3	4 08.3	V. & N.	Height	6 06.7	7 43 to 11 49 p.m.	..	N & N. by W.	0	Serene,	Clear, ..	∞	Serene,		
16	..	..	4 18	7 06	..	V.	1 19	3 00.4	9 25.5	7 00.5	4 00.1	V. & N.	0	Serene,	∞	∞	Serene,		
17	1	01	6 04.9	6 58	7 02.7	00 09.8	North,	2 33	2 08	10 13	7 05.3	5 00.3	V. & N. N. E.	0	..	∞	∞		The Zero point is ascertained by two marks in the walls of the Tide Gauge, with reference to a fixed point.
18	2	38	6 01.5	8 23	7 10.6	1 09	N. N. E.	3 17	2 06	10 22	8 02.5	5 08.5	V. & E. by N.	0 47.5	..	∞	Overcast,		
19	3	06	5 05.8	9 10	8 05.5	2 11.7	N. & W. & V.	3 26	2 02.6	10 50	8 05.2	6 02.6	V. & N. by E.	0	..	∞	∞		The Zero point is ascertained by two marks in the walls of the Tide Gauge, with reference to a fixed point.
20	3	38	5 01.5	9 48	8 09.5	3 08	N. by E. & V.	4 18	1 07.5	11 13	8 05	6 09.5	V & N.	0	Serene, ....	∞	∞			Serene,
21	3	58	4 03.5	10 17	9 01.5	4 10	N. N. W. & V.	4 56	1 07	11 26	8 06.7	6 11.7	V. & N.	0	..	..	....		(Sd.) E. M. ELLIOT, 2d B. Engrs. Supt. Magt. Singapore.
22	4	38	3 06.7	10 51	9 05	5 10.3	N. & V.	Putting on fresh paper.	11 43	8 09.8	..	N.	0	..	∞	∞	....	
23	4	51	3 02	11 20	9 10	6 08	N. & V.	5 38	1 11.6	12 02	9 01.8	7 02.2	V. & N. & E.	0	..	∞	∞		The Zero point is ascertained by two marks in the walls of the Tide Gauge, with reference to a fixed point.
24	5	26	3 00	11 54	10 01.4	7 01.4	N. & E. & V.	6 13	2 05	N.	0	Overcast, ....	..	∞			clear Z
25	6	12	2 03.3	00 18	9 03.8	7 00.5	North,	6 40.5	2 05.5	00 29	9 08	7 02.5	N. by E. & V.	0	∞	∞	∞		....
26	6	55	1 09.2	00 41	9 03.6	7 06.4	North,	7 14	2 10	1 13	9 01.6	6 03.6	N. N. E. & V.	0	Serene, ....	∞	∞		....
27	7	48	1 09.9	1 13	9 03	7 05.1	V. & N. N. N.	7 28	3 07.7	1 50	8 08.8	5 01.1	E. & V.	0	Serene,	∞	∞		Overcast,
28	8	19	1 09	1 45	9 01	7 04	V. & E. by N.	8 04	4 01.9	2 56	7 10	3 05.1	N. E. by E. & V.	0	Serene,	∞	∞		∞

N. B. In the column of the direction of the wind; where there are two directions, the former is for low water, the latter for high water.

1841.	Morning Tide, A. M.					Wind.	Evening Tide, P. M.					Wind.	Rain in Inches.	Weather.				Remarks
	Low Water.		High Water		Range of Tide.		Low Water.		High Water.		Range of Tide.			Morning A. M.		Evening P. M.		
	Time.	Height.	Time.	Height.			Time.	Height.	Time.	Height.				2 16	8 16	2 16	8 16	
March,																		
1	8 19	1 11	2 28	8 09.2	6 10.2	N. & E. N. E.	9 06	5 02	4 29.5	6 09.4	1 07.1	North, ....	..	Serene,	\ Harrison, \	\ Z & #	\	The direction of the wind is taken at each of the Tides, and is put down in the same order as the Registry of the Tides in the weather column
2	10 38	2 01.2	3 11	8 04.5	6 03.3	V. & N.	10 41	5 10.7	6 48	6 07.6	00 08.9	N. & N. N. E. ....	..	Serene,	\	\ E. & W. \	\	
3	12 35	2 00.3	4 37.5	7 11.9	5 11.6	V. & N.	00 31.5	2 00.1	8 41	7 02.5	5 02.4	V. & N. E. by N	..	Z Clear,	\ # Z clear	\ #	\ - # \ Z		Z Stands for Zenith.
4	1 01	5 10.5	6 56	7 09.2	1 10.7	N. E. by N.	1 56	1 09.4	9 36.5	8 09	6 02.6	V. & N. by E. ....	..	Serene,	\	\ #	Serene, #	Ditto ditto Horizon
5	2 18	5 05	8 11	8 05.9	3 00.9	N. by E. & V.	3 00	1 02.6	10 03	8 04.8	7 02.2	V. & N. E. by N.	..	..	\ # Z clear	\ Z & S. #	- #	\ Cumulus — Stratus.
6	2 56	4 07.6	9 14	9 01.5	1 08.9	N. E. by N. & V.	3 51	1 02.7	10 40	8 11.5	7 08.8	V. & N. W. by W.	..	Serene,	\ - # \ Z	\ # Z clear,	\ - # \ Z	\ Cumulus — all the other marks are combinations of these.
7	3 42	3 09	9 55.5	9 11.3	6 02.3	N. W. by W. & V.	1 28	1 01.2	11 08.5	9 00.1	7 10.9	W. & N. N. E.	0 31	..	..	..	..	● New Moon
8	4 25	2 09.7	10 47	10 03.5	7 05.8	N. N. E. & V.	5 16	1 06	11 26	9 03.3	7 09.3	V. & N. E. by N	..	\	\ Z & # -	\ - # \ Z	Serene, #	First Quarter
9	5 10	2 00.6	11 21	10 01.1	8 03.5	N. E. by N. & V.	5 36	1 10	11 37.5	9 01.6	7 06.6	E. N. E. & N. E.	..	Serene,	\ Z & # -	\ - # \ Z	\ -	○ Full Moon
10	5 12	1 07.2	11 58.5	9 11.0	8 04.7	N. E. & V.	6 13	2 02.5	..	..	..	E. by N.	0 25	\	\ Z \ #	Nimbus, Overcast, ..	☾ Last Quarter	The time is mean time to the nearest minute.
11	No obser- vation.				Clock out of Order			No obser- vation.				..	0 26	\	\ & \ - # Z clear,	Nimbus, Overcast, ..	..
12	7 01	1 06	00 10.5	9 05	7 11	N. W.	7 01	3 07.5	1 38	8 09.7	5 02.2	N. by W. & V.	..	- # \ Z	\ Z \ - #	\ & \ - # \ Z	Overcast, ..	
13	7 39	1 07	1 01	9 02.2	7 07.2	N. by W.	7 30	1 00	2 08	7 11.5	3 11.5	N. N. W. & V	0 15	Serene,	\ - # \ Z	Overcast, ..	Serene, ...	
14	8 30	1 10.5	1 32	8 08.2	6 09.7	N. by W.	8 16	1 10	3 03	7 02.5	2 04.5	N. N. E. & N. W. by N.	0 91	Serene, ....	..	..	..
15	9 21	2 06	2 09	8 05.2	5 11.2	V. & N. N. E.	8 35	5 05	1 00	6 02.1	00 09.4	N. N. E. & N. N. W.	0 18	Serene,	\ #	Overcast, ..	Z clear # -	(Sd.) E. M. ELLIOT, 2d B. Rgrs. Supt. Mgt. Singapore
16	10 27	3 01	2 23	7 11	1 10	V. & N. N. E.	9 46	6 00	8 14	6 00.5	00 00.5	North,	1 11	Serene,	\ #	Overcast, ..	Z clear, ..	
17	11 57 to 1 01 P.M.	3 01.5	3 37.5	7 01.8	3 09.3	V. & N.	11 57 A.M. to 1 01 P.M.	3 01.5	9 00.5	6 08.2	3 03.7	V. & W. by S	0 04	..	- # \ Z	\	..	
18	1 15	6 01.8	6 21	6 09.8	00 08	W. by S. & S. W. by W	1 57	2 08.7	9 21	7 00	4 03.3	V. & N. W. by W.	0 01	..	- #	Overcast, ..	Overcast, ..	
19	2 18	5 01	7 56	7 05	2 01	N. W. by N.	2 39.5	2 05.8	9 12	7 07.8	5 02	V. & N.	0 08	..	\ Z	Overcast, ..	Serene,	
20	2 39	4 08.5	8 16	7 11	3 02.1	North, ..	3 20	2 00.6	10 02	8 00.7	6 00.1	V. & S. S. E.	0 06	..	\ #	\ -	Overcast, ..	
21	3 17	1 03.1	9 28.5	8 09	4 05.6	S. & V.	3 47	2 01	10 10.5	8 04	6 03	V. & N. by W.	..	..	..	..	..
22	3 33	3 05	9 45	9 03	5 10	N. by W. & V.	4 08	1 10.8	10 26	8 08.1	6 09.3	V. & N. E. by N.	0 025	..	- # \ Z	\ Z	Serene,	
23	4 01	2 07	10 17	9 06	6 11	N. E. by N. & V.	4 57	1 11.5	10 55.5	8 11.2	6 11.7	N. E. by N. & N.	0 425	Serene,	- # \ Z	Nimbus, ..	..
24	4 51	2 00	11 03	9 08	7 08	N. N. W. & V.	5 16	20 15	11 13	9 03	7 01.5	S. & N. N. W.	0 225	..	\ #	\ #	- # Z clear,	
25	5 28.5	1 05.5	11 47	9 07.3	8 01.8	W. by S.	5 50	2 07.4	11 37	9 06.5	6 11.4	S. E. by E. & N. E. N.	..	Z Clear,	Overcast,	\ # \ Z	..	
26	5 51	1 02.8	..	..	..	N. E.	6 10	3 01.5	11 55.5 (6 05.3)	9 07.2 (9 06.8)	6 05.7 (6 05.3)	N. W. ....	..	Z Clear,	\ - #	\ #	\ # \ Z	
27	6 29	1 01.5	00 02	9 07	8 05.5	N. W. & V.	6 33	3 08.6	1 18	9 00	5 03.4	W. N. W. & V	0 21	Serene, ...	- & \ #	Zenith clear,	\ & \ -	
28	7 17	1 01.8	00 37	9 07.1	8 02.6	W. N. W.	7 09	4 07.8	2 10.5	8 09.5	1 01.7	N. by E. & V. ....	..	..	..	..	..
29	8 11	1 09.8	1 17	9 06	7 08.2	V. & N. by E.	8 11	5 02.5	3 21.5	7 11	2 08.5	N. E. & E. by S.	..	Overcast,	\	\ # \ Z	Serene,	
30	9 19	2 00.3	1 55.5	9 01	7 00.7	E. by N. & N. by E	9 21	5 09.5	1 10	7 03.2	1 05.7	N. by W. & N. by W	..	Serene, ..	\ # \ Z	- & \ #	Serene,	
31	11 04	2 01.2	3 01	8 06.8	6 05.6	V. & N. by W.	11 21	5 10	6 51	7 01	1 03	S. by W. and S.	..	\ and \ ..	\	\	\ # Z clear,	
Total,													1.275	Inches,				

